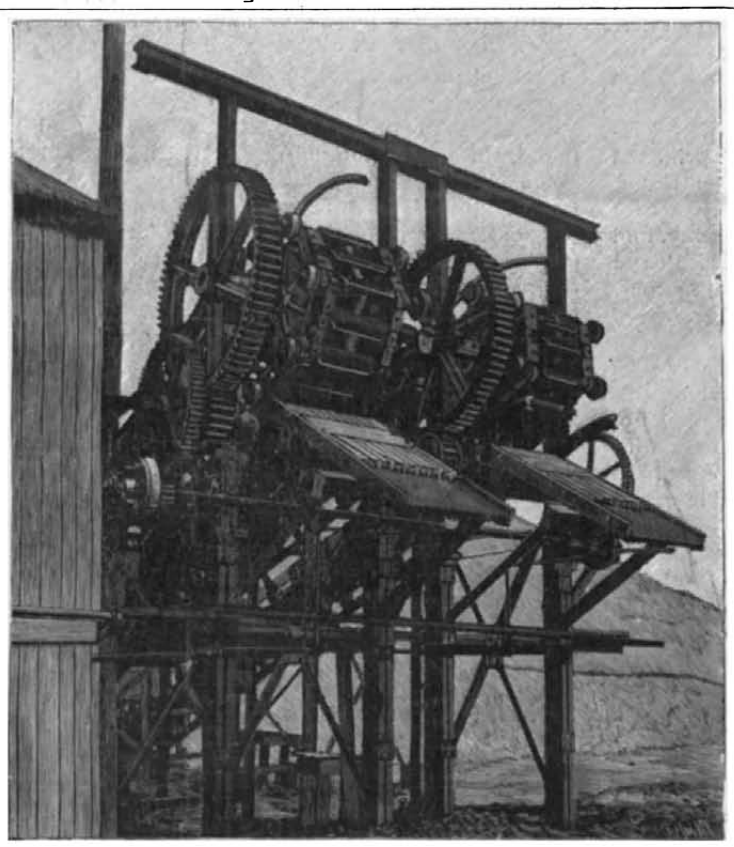
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1900, by Munn & Co.]

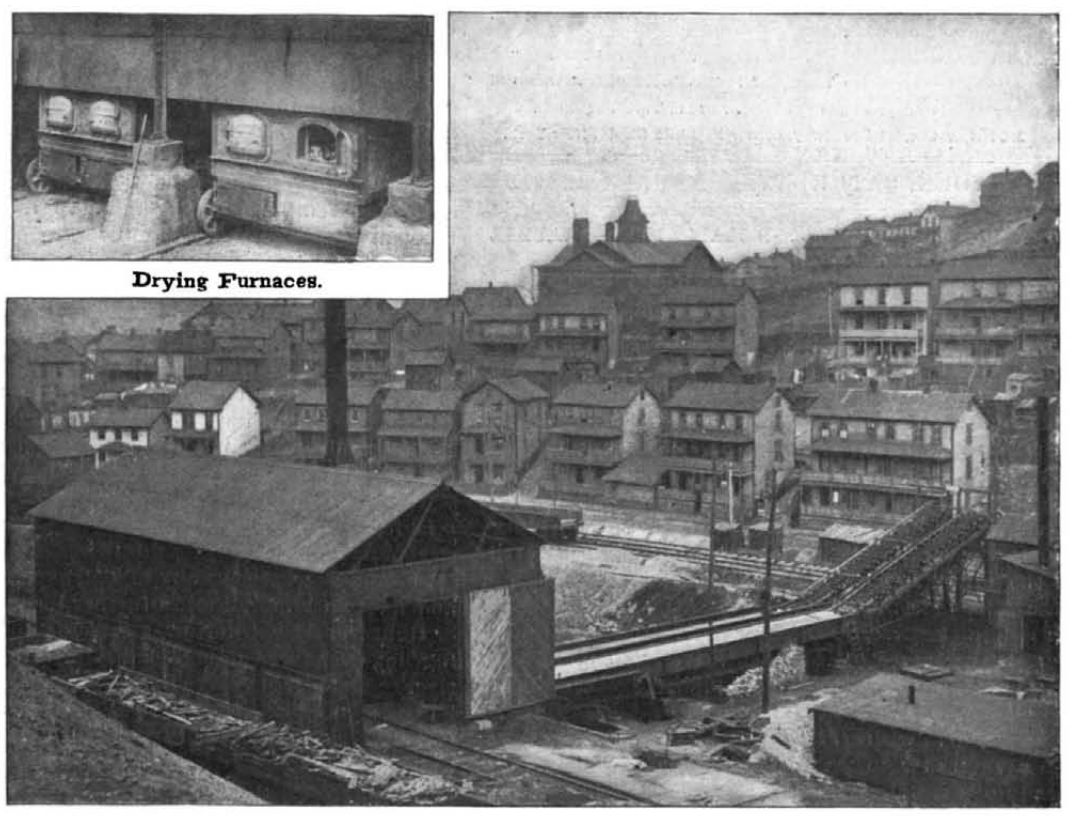
A WEEKLY JOURNAL OF PRACTICAL INFOPMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXII.—No. 8. ESTABLISHED 1845. NEW YORK, FEBRUARY 24, 1900. $3.00 A YEAR. WEEKLY.



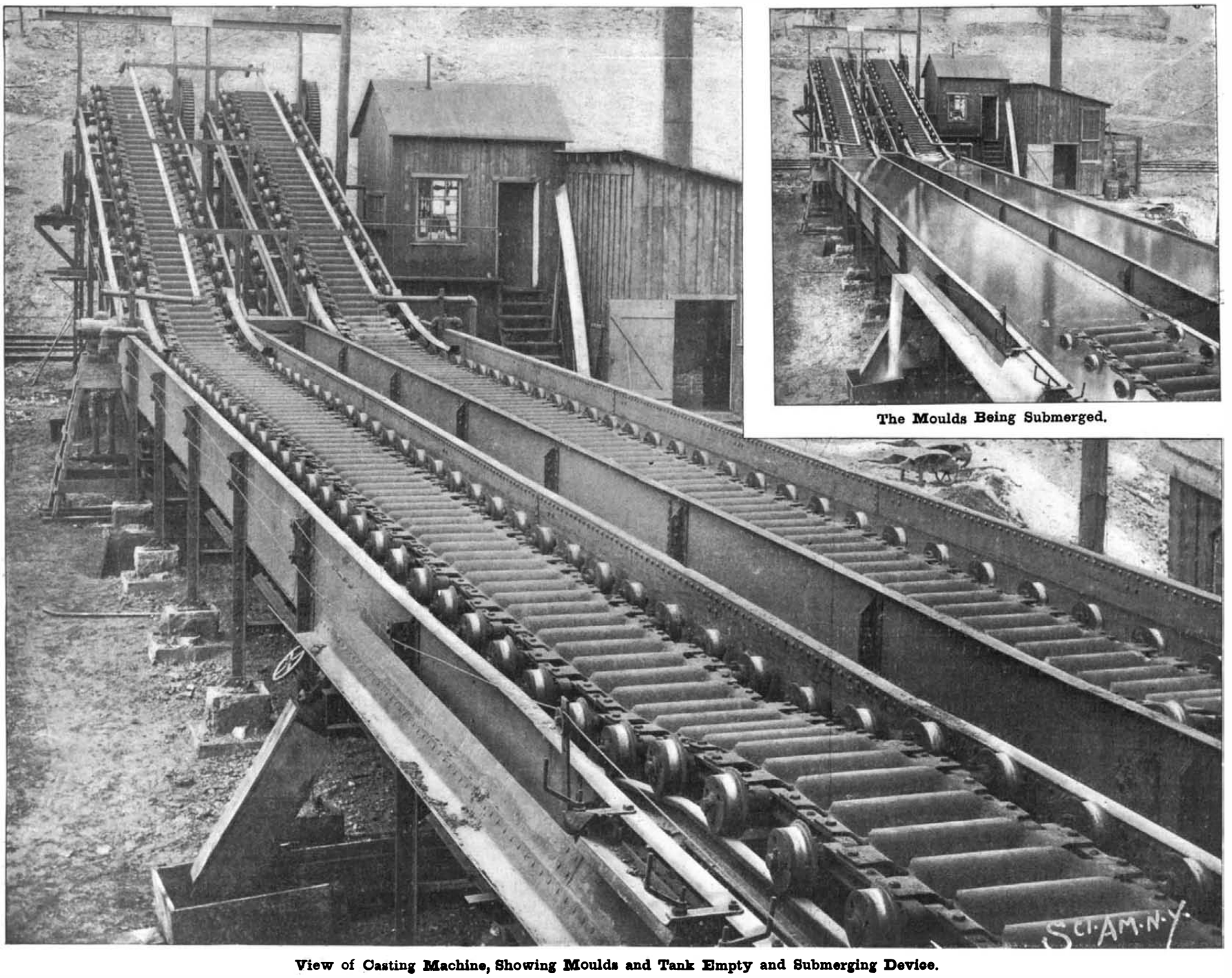
Discharging Devices at Head of Incline.

Drying Furnaces.



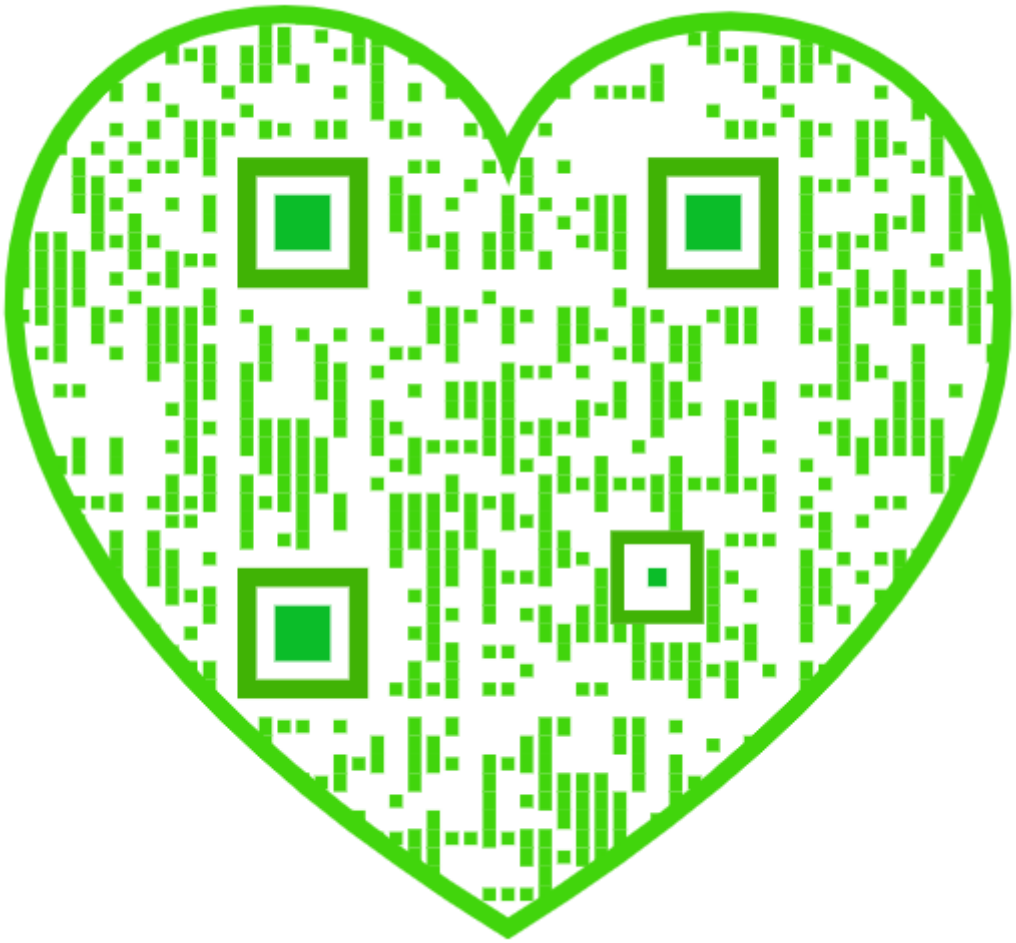
General View of Plant, Showing Ladle House.

The Moulds Being Submerged.



View of Casting Machine, Showing Moulds and Tank Empty and Submerging Device.

A NEW METHOD OF CASTING PIG IRON IN MOULDS AND SHIPPING THE PRODUCT.—[See page 118.]



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, FEBRUARY 24, 1900.

REVIVAL OF THE SECOND-CLASS MAIL MATTER QUESTION.

It is surprising with what persistency fallacies of legislation, which we thought had been forever laid to rest, will ever and again rise from the dead, and strut, very much alive, through the halls of Congress. As between the orthodox ghost and the shades that haunt the assemblies in which the laws of the country are made, there is this difference: that whereas the former has certain clearly defined characteristics in the way of an elusive personality, clinging cerements, and a redolence of the vault and the mausoleum, these legislative ghosts will vary in shape, size, and character according to the idiosyncracies of the bill in which they are clothed for presentation to Congress.

The latest resurrection of exploded theories has taken place in the House of Representatives, and under the personal management of Mr. Loud, the chairman of the Committee on Post Offices and Post Roads. Mr. Loud is a man with an idea, who for several years past has been trying to persuade Congress to enact that idea into law. Mr. Loud has several other ideas, subsidiary to the central one, and they all relate to the conveyance of second-class matter through the mails. While some of them are harmless, or mildly beneficial, others are decidedly retrograde and pernicious, and, if passed into law, would seriously curtail the usefulness of that splendid institution known as the American Press.

The first provision of the bill, to prohibit sending as second-class matter "publications purporting to be issued periodically and to subscribers, but which are merely books or reprints of books," is, we think, a good one. It is aimed at those publishers who, by splitting a book into sections and mailing these sections without bindings and apparently in second-class form, seek to circumvent the law by mailing third-class matter at second-class rates.

Having said this much in favor of Mr. Loud's bill, we find little else that is not earnestly to be deprecated both by the publisher and public. In the first place, it involves the vicious principle of *local disqualification,* by establishing a zone system of charges for carrying periodicals, under which the rate is to be one cent a pound for the first one thousand miles and two cents a pound for distances exceeding one thousand miles. This would involve a local discrimination in favor of central cities like Chicago and St. Louis, most of whose mailing distances would be within the zone, and against coast cities like Philadelphia, New York and San Francisco, a large portion of whose second-class matter, being sent beyond the zone, would be charged double rates.

Apart from the question of local injustice, the bill is to be condemned as a return to an old system that was in vogue in the early days of the Post Office and was long ago abandoned for the present system of one price for all distances. We thought it was pretty well understood that the introduction of "penny postage" had proved to be the most far-sighted and beneficial reform in the history of the Post Office. Mr. Loud evidently does not think so, and in the unlikely event of his zone system for second-class matter becoming law, we might reasonably look for a further bill to include first-class matter as well.

If it is well to tax distance on a newspaper, why not on a letter?

It is little wonder that the Post Office Department, which surely should be well informed as to the value of any proposed changes in its laws, is opposed to the zone system as being retrograde in its spirit and impracticable in its operation. For the existence of a zone system implies that not merely the postmasters but practically every citizen who uses the mails must be aware of the distance from every post office in the United States to every other office, a supposition that is as ridiculous as it is impossible.

The author of this perennial bill, which is startlingly varied in its present presentation by the addition of a zone tariff, is surely little acquainted with the mailing department of a great daily or weekly newspaper, or he would never have inserted a clause requiring "publishers . . . before depositing second-class matter in the Post Office to separate the same into United States mail sacks or bundles, by States, cities, towns and counties, as the Postmaster-General may direct." If the public is to perform one part (and no small part) of the duties of the Post Office clerks, why stop at the sorting? What about the canceling and dispatching?

THE PROBLEM OF SAN FRANCISCO BAY.

In California a renewal of the old agitation against hydraulic mining has been started by influential agriculturists. It is asserted that the restraining dams built under the Camenatti act, for holding back the debris of the mines, are ineffectual and do not fulfill the purpose intended, the result often of faulty construction or deliberate indifference to the careful requirements of the law. Chinese are the principal offenders, and much litigation has been the result. Floods have swept many of the frail structures, with all their accumulations of sand and rock, away, and the consequences have been the ruin of agricultural lands and the increased shoaling of navigable streams. Fifty years ago began the disastrous filling up of streams, caused by the general and unrestrained pursuit of hydraulic mining. No estimate can be made of the quantities of debris washed down by this process. The evil results are visible in thousands of acres of fertile valley lands deeply covered over with sterile sands washed down by flooded streams from the mountains above. The area of navigable waters of the State is seriously curtailed.

In 1849 the Sacramento River was a clear and limpid stream navigable for vessels drawing 17 feet of water as far inland as where the city of Sacramento now stands and for two hundred miles further for vessels of seven or eight feet draught. Now, steamers and barges drawing not over three and one half feet can navigate the river at summer stages to Sacramento, and but twenty inches if they are bound to Red Bluff. The three fathom limit, which in 1849 extended to Sacramento, has contracted at the rate of one mile per annum for the last fifty years, and is now at Port Costa.

The Sacramento River is a stream having an average discharge of 600,000 cubic feet a minute. In 1849, Suisun Bay, into which the Sacramento and San Joaquin Rivers empty, was deep enough for any vessel at that time navigating the ocean; and Capt. Ringold, the first government surveyor to chart these waters, incorporated in his report careful directions for the guidance of square-rigged vessels navigating this bay. Now Suisun Bay is available only for light-draught schooners or stern-wheel steamers. From the beginning it has been the receptacle for untold quantities of debris, washed into it by the mountain streams.

In San Pablo Bay, embracing a large area west of Carquinez Straits, the ship channel extending from San Francisco Bay to Port Costa, the wheat terminus, which, in 1849, had a general width of two and one-half miles, with an average depth of three and one-half fathoms, in 1898 had contracted to less than a mile in width and is constantly shoaling. Thousands of acres of land bordering on the upper San Pablo, once covered at high tide, are now far above water line and utilized for agriculture. The east side of San Francisco Bay, against which the muddy currents of the streams are driven by prevailing winds, shows a decrease of depth and a constant onward march of the shoaling limit.

Mare Island straits, which early showed a depth of from four to six fathoms, were, until the present dredging operations began, impracticable even at the highest tides for ships exceeding 19 feet in draught. The battleship "Oregon," which draws 23 feet light, has never visited the navy yard on this account.

Facts like these are cited by agriculturists to justify the movement for altogether abolishing hydraulic mining, and it is admitted that unless measures are adopted for practically restraining the transfer of debris from the mountain streams into the bay, the closing of the upper waters of this magnificent stretch of navigable water to all ocean craft will result.

For over twenty years, or since the cessation of hydraulic mining, the streams of California have never regained their original limpidity, and are even now apparently bringing down as great an amount of solid matter as ever. This is accounted for, in part, by the vast mounds of debris thrown out by early operations, which eventually find their way into the current through the operations of floods. But the process of filling up the bay comes also through the involuntary assistance of the agriculturists themselves. Scientific investigation demonstrates that the silt now flowing into the bay is not from the mountains altogether, but is, in great part, the soil washed from lands plowed for agricultural purposes. The very element that so consistently demanded and achieved the destruction of hydraulic mining is now doing that for which they successfully denounced an interest which in the past has contributed so greatly to enrich the world.

The result is expected that these two great interests will eventually combine in an effort to save the splendid bay from utter destruction.

THE PRODUCTION OF GOLD.

Of the $10,000,000,000 of gold produced in the world since the discovery of America, more than one-half has been found since 1860, and more than one-quarter since 1885, or to put it in other words, one-half of the gold mined in the last 400 years has been produced within forty years, and one-fourth within fifteen years. The Treasury Bureau of Statistics has made some compilations regarding the gold production of the world in view of the temporary suspension of gold-mining in South Africa, and its possible effect upon the gold supply of the world. A casual examination of the figures of annual production shows plainly the very rapid increase during the last half of the closing century. From 1493 to 1600, $501,640,000 worth of gold was found, the average annual production being $4,644,815. From 1601 to 1700, $806,315,000 worth was mined, and from 1701 to 1800, $1,262,805,000. From 1801 to 1860, $2,120,444,000 was produced, the average annual output being $15,745,260. In the decade from 1861 to 1870 the average annual production arose to $1,126,301,500, the total production being $1,263,015,000. In the next ten years the production was slightly less, being $1,150,814,000, and from 1881 to 1890 there was also a considerable decrease, the amount being $1,060,055,600. From 1891 to 1899, the production increased in a remarkable degree, amounting to no less than $1,867,971,000, the average annual amount being $204,773,555. This makes the total production between 1493–1899, $9,833,039,600.

An examination of the amount of gold produced from the mines of the Transvaal and by those of other countries shows that the gold production of the entire world is more than double that from the Transvaal; the latter mines produced $79,213,952 worth of gold in 1898, while the production in other parts of the world was $208,214,647, making a grand total of $287,428,600.

THE UTILIZATION OF WASTES FOR POWER.

In a paper read before the Institution of Civil Engineers, of London, Sir Douglass Fox describes a number of plants in which steam is produced for motive power by the combustion of waste. Of these the Shoreditch electrical plant is the oldest and most important. In twelve months it has burned more than 6,000 tons of residues, of which ninety-two per cent was household waste, the remainder consisting of paper, straw, etc. The combustion takes place in twelve furnaces of the Manlove-Alliott type, and the steam is produced by twelve Babcock & Wilcox boilers. The waste, upon arriving at the station, is weighed, then put into carts, which are raised to a platform above by two electric elevators. The carts are provided with electric motors, which take the current from trolley wires above the platform, and thus the waste is brought to the reservoirs above each furnace. It is estimated that from eighty to ninety tons are received per day. To secure the combustion, it is not necessary to add carbon in any form to the waste, as the temperature of the furnace is from 800° C. to 1,000° C. The cinders form thirty-two per cent of the total weight; they are utilized to form béton, and when mixed with Portland cement they make an excellent paving. Three electrically-operated pumps force the water into the feed-water heater, from which it is sent into great cylindrical reservoirs placed twenty feet above the boilers, into which it then passes by gravity. The steam is nearly all utilized for the production of electrical energy, and during the year over one million kilowatt-hours were supplied to consumers.

A GREAT RUSSIAN PIPE LINE.

Russia possesses a pipe line over a hundred miles long in the petroleum region of Baku. This conduit, which is 8 inches in diameter, brings the oil collected in the Caucasus region to Batoum, on the Black Sea. It leaves from the station of Mikhailovs, on the Trans-Caucasian railway, not far from the frontier of Kutain and Tiflis. At the wells at Baku, the petroleum is collected in tank wagons and brought to the station, where it is poured into two great reservoirs having a capacity of 12,000 cubic meters. From this reservoir proceeds the pipe line in question; it is placed underneath the ground, and is provided with safety cut-off valves which divide it into sections in case of accident. On account of the grades passed over by the line, it has been necessary to provide three pumping stations; these are each equipped with three pumps operated by steam engines of 150 horse power. The maximum capacity of the pipe line is about 90 tons of oil per day. There is now some idea of bringing it to Baku, thus doing away with the wagon transportation, and to complete the line by others going from Baku to the eastern extremity of the Caucasus, toward Petrowsk; from there it is to pass to the north of the mountains by Novorossisk, and finally reach a point on the Black Sea.

AN ASSUMED INCONSTANCY IN THE LEVEL OF LAKE NICARAGUA; A QUESTION OF PERMANENCY OF THE NICARAGUA CANAL.

BY PROF. ANGELO HEILPRIN, F.R.G S.; F.G.S.A.; LATE PRESIDENT OF THE GEOGRAPHICAL SOCIETY; ETC.

A source of doubt which attaches to the Nicaragua Canal and involves the question of permanency is furnished by the level of Lake Nicaragua—the fountain-head of the San Juan River, and the summit and feeder of the proposed canal. The regulation of its level is necessarily a matter of absolute or vital importance to the canal. The very elaborate measurements of American engineers that have been made during the last fifteen years indicate for the surface of the lake an average elevation at this time of approximately 105 feet above tide.* The earlier determinations of Lieut. Baily, made from 351 levels, and with what had generally been assumed to be sufficient accuracy, placed the surface in 1838 at 128 feet 3 inches above low water at San Juan del Sur, on the Pacific side; while in 1781 the Spanish engineer Galisteo made the altitude still 5 feet higher (or, more exactly, at 133·11 feet).† It is difficult to understand these discrepancies in values or to assume that competent engineers should have erred over such short distances of measurement to the extent of twenty per cent of their results; yet the concurrence of the newer results of measurement leaves no room for doubt that either Baily's and Galisteo's determinations were faulty or there has actually been an abasement of the lake level since these measurements were made. The measurements of Lieut. Baily have been particularly commended in the earlier discussions of the canal problem, and in the historical summary of the canal project published by the Nicaragua Canal Construction Company in 1891, it is stated that "he was thoroughly competent and well equipped for the undertaking [the survey of the canal route]." He himself states that his levels were run with great care and attention by a good theodolite during a period of four months.‡

It is a little surprising that in their discussions of the possibility of maintaining a general level for the lake, neither the Nicaragua Canal Board nor the Nicaragua Canal Commission of 1897-99 makes particular reference to this earlier determination of altitude; nor does the survey of Chief Engineer Menocal take count of it. Manifestly its wide divergence from the results obtained by the newer surveys has given to it the stamp of inaccuracy, but this has perhaps not yet been proved to be the case, and it is by no means certain that the differences in values between the higher and lower elevations that have been found in recent years, with a tendency toward the lower plane, may not in part be the expression of an actual abasement of the surface, and not merely a fluctuation dependent upon the hygrometric condition of the atmosphere.§ Some evidence for considering an actual lowering of the level of Lake Nicaragua is found in the condition of its northwestern termination—the so-called Estero Panaloya. At the time of the Baily survey, and eleven years later (in 1849), when Squier passed over the region and drew his plan of the Managua-Nicaragua Canal, the Estero was open to free navigation (with water of 5 to 15 feet depth) and to the extent that Squier represented the two lakes as being separated by only four miles. Colonel Ludlow in his report states that the course of the Tipitapa (Panaloya) River between the two lakes is 23 (?) miles, and that in the dry season, at least, the channel of the river is also dry, whatever water finds its way into it from the smaller lake disappearing through fissures in the bed.

The extent of the recent fluctuations of the lake-level is, indeed, such as to have caused some of the well authenticated data that have been obtained by the different commissions to be accepted by them with both surprise and incredulity. Colonel Childs assumed the absolute fluctuation of level to be measured by not more than 5 feet, or little less than what was subsequently reported by Chief Engineer Menocal. The researches of the Nicaragua Canal Board of 1895 extended the range of variation to about 14 feet—from 96·6 to 110 to 111 feet. In the report of the Nicaragua Canal Commission reference is made to a reported variation between 97 feet and 112 feet, but the "reports of traditions" of such variation are said to be uncertain. It is admitted, however, to be "reasonably certain that it fluctuates between 100 and 110 feet above sea level, at not distant intervals."

Chief Engineer Menocal discredits the report, furnished by the Nicaragua Canal Board, of the lake ever having fallen to 96·6 feet, as "such low-lake would practically cut off the flow of the San Juan below Toro Rapids, an event not recorded in the history of the country."*

Such an extreme low stage of the river, however, appears actually to have existed at the time that it was surveyed by the English engineer Collinson, who, in his report to the Royal Geographical Society (1867), states that the water was so low that small stern-wheelers, drawing when laden only 10 inches of water, could hardly grope their way from rapid to rapid, and were finally stalled by the swift, bowlder-charged current. And yet this was the stream that Squier in 1850 compared with the Hudson and the Connecticut, and which he said was for "far the greater part of its length capable of being navigated by our largest river steamers."

It has been customary to regard the surface fluctuations of the lake as being periodic or recurrent, depending upon the seasonal changes of one or more years. But might it not equally well be assumed that, apart from the minor periodic fluctuations, there is a distinct oscillation of level, tending to a possible permanent lowering of the surface, which is dependent upon conditions largely distinct from those which are associated with the seasonal rainfall? And is it not after all likely that the high levels given by Galisteo and Baily were correct for their times? In his communication to the Royal Geographical Society already referred to, Engineer Collinson gives emphatic testimony to the lowering of the level of the lake, and suggests—what is not unlikely to prove the true explanation of the phenomenon—that it may be due to increased potentiality of the outgoing or draining waters incident to a differential rise of the land surface. He says: "Every year it becomes more evident to all living on its banks or using its stream that the flow of water is becoming less in the San Juan; and even the least observant native, dwelling on the lake, will tell how its banks are rising year by year visibly before his eyes, how the River Panaloya connecting the two great lakes is becoming drier every season, so much so that at times lately no water connection has existed between them. Noting the fact that these lakes are in the middle of the great volcanic range bisecting the Isthmus, which dies out to nothing before reaching the low alluvial shores of the Atlantic, may it not be conjectured that the gradual upheaval of the center, while the coast has remained almost unmoved, should year by year increase the gradients of the river, and by creating a more rapid flow of water cause the perceptible drainage of the lakes and lower the level of their waters? Also, will not this help to account for the formation of the deltas and silting up of the estuary of the San Juan?" At this time it would appear by no means unlikely that a pronounced shrinkage of the lake, brought about in the manner indicated by Collinson, did in fact take place, and it would hardly be surprising if it should be determined that a considerable dropping of the surface was effected in the period of a very few years. Indeed, the Childs survey, if we assume correctness in his and Lieutenant Baily's measurements, makes it almost indisputable that this must have been the case, for in 1850 the level of the lake had already been found reduced to 103·07 (low stage) feet.† The Baily survey was made in the interval of time between the catastrophic eruption of Coseguina (1835) on the northwest and the very violent one of Irazú (1841) on the southeast, and it was also about this period of special excitability of the crust that, as Squier reports, Nicaragua suffered most from earthquake visitations. It was in May, 1844, when the city of Nicaragua itself suffered much, that the waters of the lake "were observed to rise and fall with the throes of the earth." Naturally, it is to a period of this kind that one would look for most rapid or permanent terraine displacements.

The subject of the oscillation of lake-levels has only during the last 20 or 25 years attracted the serious attention of geographers, and only in the case of a very few lakes is the information pertaining to them of such a precise nature as to permit of definite conclusions being drawn regarding their condition. This much is known, however, that a number of lakes have undergone marked changes in volume, whether toward an increase or a decrease, in comparatively short periods of time; others have gained or lost through slow but steady accretions or diminutions extending through a considerable number of years. In some instances the oscillations can be referred to well-known causes; for others an acceptable explanation is still to be found and given. A few instances of marked oscillation, which may have a bearing upon the condition and question of permanency of Lake Nicaragua, are here given.

LAKE GENEVA.—The height of this lake above the level of the Atlantic is according to the more recent measurements 1,218·8 feet. On the old Carte Fédérale Suisse it appears with 375·03 meters or 1,229 feet, an excess of 10·2 feet over the newer determinations. During the past century, according to the researches of Prof. F. A. Forel, the surface oscillation between the highest (July 16, 1817) and lowest (Feb. 4, 1830) levels was 8·7 feet.

GREAT SALT LAKE.—The noted fluctuation of this lake is compassed within 11 to 13 feet. On Stanbury's map of 1850 it is represented as covering an area of 1,750 square miles and having a maximum depth of 36 feet. The newer survey (1869) of Clarence King placed the area covered by it at 2,170 square miles, and its maximum depth at 49 feet.

NEUSIEDLER SEE (or Fertö-Tava) of Hungary.—According to the investigations of Béla Széchényi, this lake began slowly to empty itself in 1854, and became quite dry in 1868. In 1869 the waters again began to accumulate, and by 1879 had once more reached full high water mark. A protracted period of increase was noted in the years 1744-55.

LAKE TANGANYIKA (East-Central Africa).—The marked increase in the volume of this lake was noted by both Thompson and Stanley. The latter asserts, from soundings made by himself and the testimony of reliable natives, that within a period of some thirty years preceding 1876 the surface of the lake had risen fully 18 to 20 feet.

LAKE ILOPANGO, in Salvador, Central America.—The most remarkable changes of level recorded in the case of any lake are those which were made known by Profs. Ortega and Rockstroh, representing an official Guatemalan Commission, in the course of their investigations into the eruption of the volcano of Lake Ilopango in 1879-80. It was then observed that between December 31 and January 11 the surface of the lake had risen just four feet. Through the increase in volume of 66,000,000 cubic meters the lake changed its moderate drain into a broad and tumultuous torrent, which in a short time so rapidly degraded its channel as to cause a sudden subsidence of the lake. A lowering of the surface began on January 12, and within three hours the waters had subsided 8·3 feet. On February 11 the surface had been reduced to 30 feet below the highest stage, and on March 6 it was still further lowered by 3·5 feet. In a period of less than two months, therefore, the surface had fallen 33·5 feet, and the lake lost in volume, as estimated, 635,000,000 cubic meters. This extraordinary lake measures approximately 5·5 miles in length and 4·3 miles in width.

It will thus be observed that the fall of Ilopango considerably exceeds that which is indicated for Lake Nicaragua in the difference between the measurements of Baily and Childs (or Menocal), and this fact becomes of special interest when it is recalled that both lakes are hardly less than close neighbors of one another, and that their phenomena are largely associated with the phenomena of volcanism of one and the same region. Unfortunately we possess no extended history of Lake Nicaragua, and seemingly the only precise geographical data that are extant regarding it, and which antedate the Childs survey, are just those that are contained in the reports of the authorities whose measurements differ so largely from the ones of more recent date. Hence, they can give evidence neither for nor against accuracy.

This lack of comparative knowledge of the physics of the lake and river region of Nicaragua in its bearing upon the construction of a canal has been properly emphasized by the Nicaragua Canal Board in their report of 1895, and its existence is also fully appreciated by Mr. Menocal. In a review of the engineers' report he significantly says: "In a country like Central America, where the range of rainfall in the same locality varies as much as 100 inches from one year to another,* and 200 inches or more in the same year between points less than 100 miles apart, theories based upon observations extending over twenty years may be entirely upset the twenty-first." Hence, in conclusion, it may not be safe to assume that the earlier measurements of the lake were erroneous, and rather would one believe that:

1. The level of Lake Nicaragua is inconstant.
2. The surface had dropped 15 to 20 feet in the period of little more than half a century.

THE death of a noted evangelist brings to mind the fact that he and his collaborator exerted the most beneficial influence upon the organ trade for many years. When they were at the height of their success, people all wished to be able to sing their hymns at home, and an organ seemed to produce the best effect, so that their tour was always sure to be followed by substantial orders for small organs suitable for the household.

---

* See the reports of Chief Engineer Menocal, of the Maritime Canal Company, and of the Nicaragua Canal Board. Col. Childs, in 1851, determined the ordinary high water to be 102 feet 10 inches above Pacific high tide and 111 feet 5 inches above low tide.

† Galisteo's measurement was obtained from 347 levels, of about a hundred yards distance, starting from the Gulf of Papagayo, on the Pacific Coast. The Spanish MS. referring to this determination was formerly deposited with the archives of Guatemala, and was copied by Mr. Thompson before 1825.

‡ Fitz-Roy corrects Baily's measurement to 125 feet 6 inches—"mean elevation of the lake above mean height of Pacific Ocean."

§ Col Ludlow, in his testimony given before the House Committee of Interstate and Foreign Commerce, gives a lowest stage of the water of 96·6 feet. At other times it has stood at 98·6, and May 2, 1872, 100·97 feet In 1873, as determined by Commander Lull, the surface-level was 102·28 feet. The extreme range within a few years has therefore been 14 feet. There is seemingly a tendency to hold to the lower levels.

* Testimony before the Committee of Interstate and Foreign Commerce, Senate Document 315, 1896, p. 69. Mr. Menocal, in his various reports, does not appear to have confined himself to a strict unit of measurement for the surface of the lake. In his report addressed to the Directors of the Nicaragua Canal Construction Company, January 31, 1889, it is stated that the elevation of the lake at the time the surveys were made was 102·5 feet; elsewhere its "elevation above mean sea level is taken at its mean as 110 feet."

† On September 19, 1850, it was 105·62 feet.

* In the record of rainfall at Rivas kept by Dr. Flint for the years 1880-1894 a maximum and minimum of 105 and 32 inches, respectively, were found. A precipitation of 108 inches was determined to add 154 inches (12·8 feet) of water to the lake. At Greytown a rainfall of 296 inches has been recorded.

TWO FORMS OF A NEW DISH-WASHING MACHINE.

In the accompanying illustrations we present two forms of a new dish-washing machine, so constructed that the dishes to be cleaned are held rigidly in place to avoid all danger of breakage. The machine is the

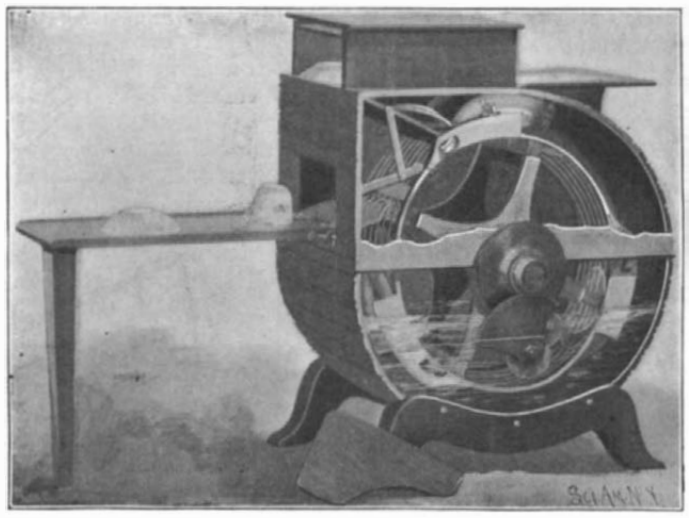


Fig. 1.—AN AUTOMATIC DISH-WASHER.

invention of Robert D. Parry and Edwin Evans, of Poultney, Vt.

The power-driven machine shown in Fig. 1, designed for hotels and restaurants, is composed of two parts, a water-reservoir and a cover hinged or hooked on the

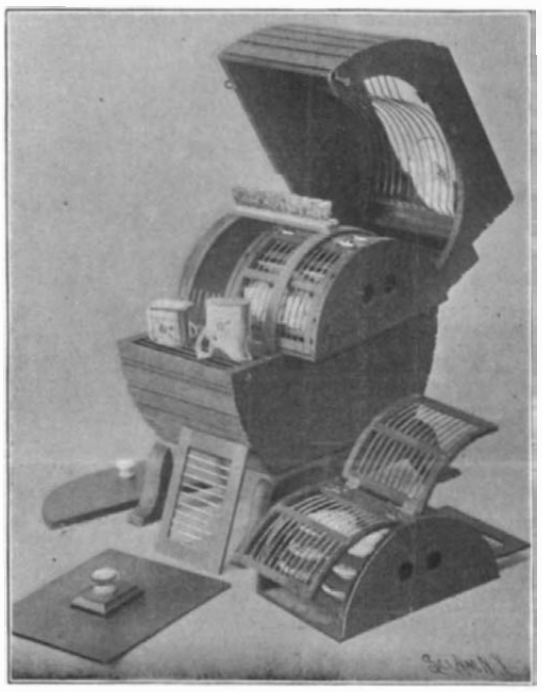


Fig. 2.—ANOTHER FORM OF DISH-WASHER.

reservoir. Within the water-reservoir two carrier-frames are mounted, the one rotating within the other. The outer carrier-frame is provided with spring-pressed clips shaped to receive and hold a dish firmly; the inner carrier-frame is provided with brushes, which pass over the inner surface of the dishes held in the clips, the outer surface being cleansed by brushes mounted in the reservoir. The two carrier-frames are so mounted and connected by gearing that the inner brush-carrying frame rotates at a speed many times that of the outer dish-carrying frame. In the cover of the machine two openings are formed—an upper feed opening and a lower discharge opening. As the dishes are placed in the feed-opening, the clips are automatically opened by spreaders mounted in the cover to receive the dishes; the dishes in rotating are thoroughly brushed and washed; as they reach the discharge opening another spreader opens the clips, thus releasing the dishes and enabling them to glide out upon the table. The water-reservoir can be heated in any desired manner. The inventors claim a speed of more than one dish per second for their power-driven machine.

The smaller hand-driven machine, shown in Fig. 2, designed for family use, differs from the first in some details of construction. A single carrier-frame is used, containing semi-cylindrical sections similar to that lying beside the machine in Fig. 2. Each section consists of two hinged outer members and a number of horizontal wire-work trays, upon which the dishes are placed. Brushes on the outer portion of the frame pass over the outer surface of any dish placed on the wirework rack fixed immediately over the carrier in the cover.

Both of the machines described are designed to wash dishes of all kinds, as well as knives, forks, and spoons. Public tests made by the inventors have demonstrated the utility of their device.

A WORLD'S RECORD IN BRIDGE BUILDING.

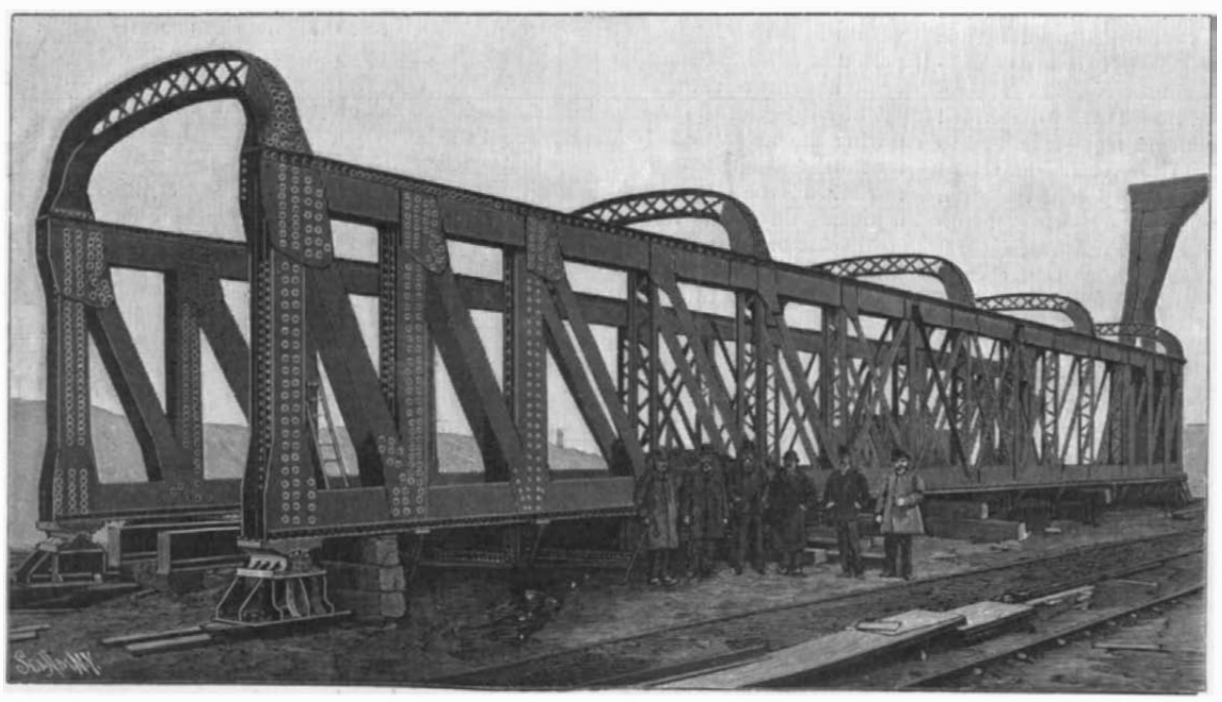
A feat in bridge building which, according to our English contemporaries, establishes a world's record for rapid construction, has lately been accomplished by the Patent Shaft and Axletree Company, of Wednesbury, England.

When General White committed the initial and, as events have proved, the most stupendous blunder of the present war, by assuming a defensive position in the town of Ladysmith instead of retiring from the hilly country to the south bank of the Tugela River, the Boers promptly availed themselves of the opportunity thus offered to isolate 10,000 of the British army, by rushing down to the Tugela River and blowing up the railroad bridge at that point, and also a smaller bridge at a place called Frere, a few miles nearer the sea coast.

The Natal government, immediately upon learning of the disaster, gave an order for the rebuilding of both these bridges; and they took advantage of the opportunity thus offered of building a much stronger superstructure to meet the increase in the weight of locomotives and trains, which had taken place since the bridge was first erected in the year 1877. The crossing over the Tugela at Colenso consists of five spans of 105 feet each, while that at Frere consists of two spans of the same length. It so happened that drawings for a more substantial bridge were in existence, and the Natal government was enabled to call for bids for their immediate construction.

Tenders were invited both in England and America, with the result that the contract was given to the Patent Shaft and Axletree Company, who undertook to deliver the first span in six weeks from the date of the contract. The order was given on the 21st of December, and the first span was finished on the 13th of January. After deducting the various holidays of the season and the three intervening Sundays, it is seen that the whole span was completed in nineteen working days. To appreciate the celerity with which the work was done it should be mentioned that when the order was received, nothing was in stock at the company's works except the ingots from which the structural material was rolled. According to The Engineer, to which we are indebted for our illustration, the company received the order at 9 o'clock A. M. on the 21st, and by 5 o'clock P. M. on the same day one hundred tons of the material had been rolled at the company's works, and tested and approved by the engineer of the Natal government.

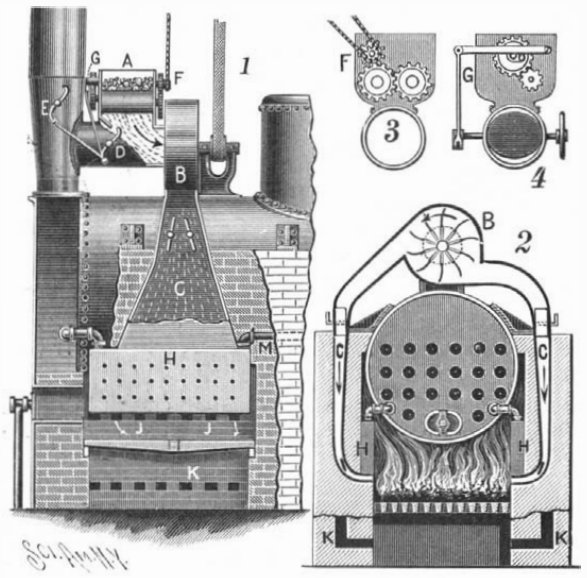
It will be seen that the bridge is of what is known as the "through" type, with riveted connections throughout. The trusses are shallower than would be used in this country, so shallow indeed that triangulated lateral bracing of the usual type cannot be used, the lateral stiffening of the upper chords being done by means of five arched members which extend across the bridge at every third or fourth panel-point. The bridge is 16 feet wide in the clear, and as the railroad it accommodates is of only 3 feet 6 inches gage, there is a space for pedestrians or horse traffic on either side. Each of the spans weighs 105 tons, or a ton to the foot lineal of the bridge. In view of the fact that the edge of the plates of which the bridge is built are all planed, involving about 7,500 feet lineal of planing, and that there are 69,000 rivet holes to be drilled in each span, it must be admitted that every credit is due the firm for such rapid work. On January 19 two of the spans had been built and work had been begun on the third, fourth and fifth spans, while the material for the whole seven had been rolled, cut to size, tested and approved.



FIRST SPAN OF NEW BRIDGE ACROSS THE TUGELA, NATAL—BUILT IN NINETEEN DAYS.

A MECHANICAL STOKER FOR FURNACES.

A patent has been granted to Robert M. Campbell and Albert H. Schofield, of Port Huron, Mich., for a novel device by which crushed fuel is fed to a boiler furnace and heated by the hot gases passing from the furnace. Fig. 1 is a longitudinal sectional elevation of a boiler, showing the device applied. Fig. 2 is a transverse section through the feeding chute. Figs. 3 and 4 are details. At the sides of the furnace beneath the boiler,



AUTOMATIC FEEDING SYSTEM FOR BOILER FURNACES.

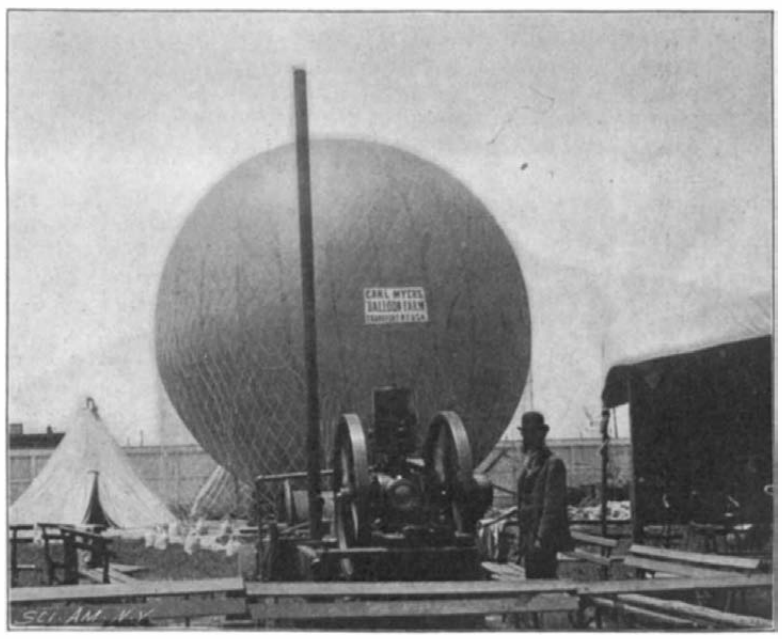
water-legs, *H*, are located through which the feed-water passes on its way to the boiler. The grate is located beneath the water-legs and beneath the lower ends of the chutes, *C*, through which the fuel is introduced. Fresh air is supplied to the furnace by the flues, *K*, the air being heated before it reaches the burning fuel. The gases after having traversed the boiler enter the smoke-stack, which is provided with an adjustable damper, *E*. Fuel is supplied to a hopper, *A*, provided with crushing rollers in its lower portion. The rollers, as shown in Fig. 3, are driven by a chain, connected with gear-wheels, *F*, on the roller shafts. The rollers and hopper are placed immediately above a pipe connected with the smoke-stack and provided with a damper, *D*, by which the gases are prevented from passing into the pipe from the smoke-stack. The dampers, *D* and *E*, are connected and automatically opened and closed alternately by the mechanism shown in Fig. 4, consisting of gear-wheels operating a lever and a link, *G*, by means of a crank-pin. When the damper, *D*, is closed, the damper, *E*, is open. At the end of the pipe containing the damper, *D*, a casing, *B* (Fig. 2) is placed containing a fan, rotated by a belt and pulley. This fan discharges the crushed fuel into the chutes, *C*, and thence into the furnace. The chutes, it will be observed, are widened as they reach the grate to a width equal to the length of the furnace. The chutes, *C*, can be provided with dampers. To distribute the fuel crushed by the hopper-rollers, the chutes, *C*, are provided with adjustable deflectors. This mechanism periodically draws hot gases from the chutes, leads these gases away from the boiler, and discharges them back into the furnace, carrying with them the finely divided fuel, which is therefore heated before entering the furnace. When the damper, *D*, is closed, the gases pass directly up the stack, and no fuel is fed, since there is no draft through the pipe containing the damper, *D*. This condition lasts but a short time. By this automatic feeding system, the gases are completely burned and the maximum calorific efficiency of the fuel secured; the fuel, being finely crushed before entering the furnace, is quickly consumed.

THE PROGRESS OF PRACTICAL AERONAUTICS DURING 1899.

The year 1899 has not been marked in the United States by any great practical advance in actually navigating the air. The advance in the construction and use of aerial devices has been most interesting. We have been favored by Mr. Carl E. Myers, of Frankfort, N. Y., the proprietor of the "Balloon Farm," with some interesting details of the captive balloon which he installed at Coney Island and which consisted of a farm wagon on which was mounted a kerosene engine and windlass. This is, according to Mr. Myers, the only portable motor windlass for controlling a captive balloon ever built or used in the country, and our engraving gives an excellent idea of it. The motor was of 4 horse power, and the friction clutch pulley operating the windlass was arranged so that the power was multiplied. The 14-inch reel of the windlass held 1,000 feet of hemp cable, and the motor ran at 400 revolutions per minute, and the expenditure of kerosene was only about half a gallon per hour. The apparatus worked so well and was so simple that it appears to be a good type for future development for airship motor power. After the passengers had entered the basket, the balloon rose almost as freely as if cut loose, and in less than a minute rose to the extreme length of the cable, giving the aerial tourists exactly the sensation of a free balloon flight. With the aid of the friction clutch pulley and the friction brake the motion of the balloon was slowed down, stopped, and finally reversed, with no consciousness on the part of the passengers that such changes were occurring, and the windlass drew the balloon down in 3¼ minutes, thus making the round trip in five minutes, including change of passengers. As might be assumed, it was one of the most interesting attractions on the island. It was installed at Paul Boyton's "Water Park." The balloon also proved of value for advertising purposes, and large opaque and translucent colored letters were separately attached to the balloon as readily as one might set type. They could also be read at night with the aid of a search light.

To add to the attractions a close cluster of eighteen incandescent 20-candle power electric lights was next used, and a number of experiments were carried on to determine whether they were safe to use, and after it was thought there was no danger of igniting the gas, they were inserted in the body of the balloon. The cluster was hung from a central pulley within the sphere by an endless loop of braided cord, carrying it and the electric wire conductors. This necessitated the abolition of the usual interior valve cord, which was removed and attached outside the balloon instead, to avoid fouling the line. Arrangements were perfected for keeping the electric light clusters in a central position in the balloon at all times when in use at night, while permitting of easy removal by day. The night ascensions proved to be very attractive.

In the daytime there was no lack of cameras, and two of our engravings show some of the results obtained. One is a perpendicular perspective of the "Water Park," with lake and grounds, a very puzzling picture when viewed from above. The other shows the West Brighton end of Coney Island. It was hoped that experiments with wireless telegraphy would be carried on between this and another balloon, but the apparatus could not be obtained in time, but two balloons were built at the "Balloon Farm" at Frankfort, N. Y., for Mr. Tesla to experiment with at Colorado Springs. Mr. Myers states that now he has a process for making very light-weight balloons which are entirely impervious to gas and which can be made in a few days. The itinerant captive balloon with its advertising facilities may be considered as having made an excellent beginning in this country, and will undoubtedly be largely in evidence in places of public resort.



CAPTIVE BALLOON WITH KEROSENE ENGINE.

Tests of Accumulators.

The Automobile Club of France, which has been active in promoting the annual exhibitions and tests of automobiles held in Paris, has also undertaken a series of tests to determine the merits of the various makes of accumulators, in order to find out which are the best for use when subjected to the working conditions of the automobile. To carry out this idea, an installation was made in the basement of the club building, the object being to subject the batteries as nearly as possible to the mechanical and electrical strains encountered en route. The automobile was imitated by a large wagon-truck upon which was constructed a platform for the batteries. The wheels were rubber-tired, and were arranged to rest upon four corresponding wheels at the floor-level, the truck being anchored at each end by tie-rods. The lower set of wheels carried a series of projections upon their peripheries and were caused to rotate by an electric motor by means of chain gearing. It will be seen that when the lower wheels are rotated the truck is subjected to a jolting movement which gives the batteries a shaking about the same as they would receive in the vehicle upon the road. The batteries consisted generally of five or six cells, each in a wood box, which was kept locked by the owner. From the boxes the wires were received by a set of switches overhead, connected with the instrument board provided with the necessary voltmeters, ammeters, and energy-registering instruments. By this means the batteries were charged and discharged according to a certain regimé and their performance noted. The points to be observed were: 1. The duration of the elements. 2. Their efficiency, or the relation of the energy given in charging to that furnished on discharge. 3. Conditions of keeping in order, necessity of repairs, etc. 4. Weight of the accumulators as compared with their capacity. The tests were made in periods of six days. The first day the batteries were charged and then discharged in series at the constant rate of 24 amperes for five hours, without being subjected to the shaking movement. The voltmeter readings for each were taken, and if the voltage fell below 8·5, the battery was removed from the circuit. After four such withdrawals, the battery was definitely excluded.

During the five other days, the batteries, previously charged, were subjected to the shaking movement, and at the same time were discharged at a variable rate, which was regulated by a revolving commutator turning once every half hour and varying the load from 20 to 100 amperes; this latter current was applied for one-half minute only. Ten revolutions were made by the commutator, and this constituted the test for each day, thus imitating the demands which would be made upon the battery by the motor when in actual service. In the intervals of repose between charging and discharging, the competitors were allowed to examine their batteries, to clean the plates, and keep up the specific gravity of the solution, but were not permitted to make repairs. The above arrangements and rules were made by a committee appointed by the club, of which M. Forestier was president and M. Hospitalier vice-president. The tests were begun on the 3d of June and closed on the 2d of December. The official report, as made out by M. Hospitalier, gives a number of interesting figures as to the performance of the accumulators. Eighteen different European makes were represented at the beginning of the test, but of these only eight were able to finish. Of these, the French makes were the Pollak, Tudor, Blot-Fulmen, Fulmen, Phénix, and Société des Métaux; the foreign makes were the Societa Italiana, of Cruto, using the Pescetto system, and W. Pope & Son, Slough, England, with the Sherrin battery. The details of the experiments and the summing up of results will be made the object of a complete report to be published under the authority of the club at a later period.

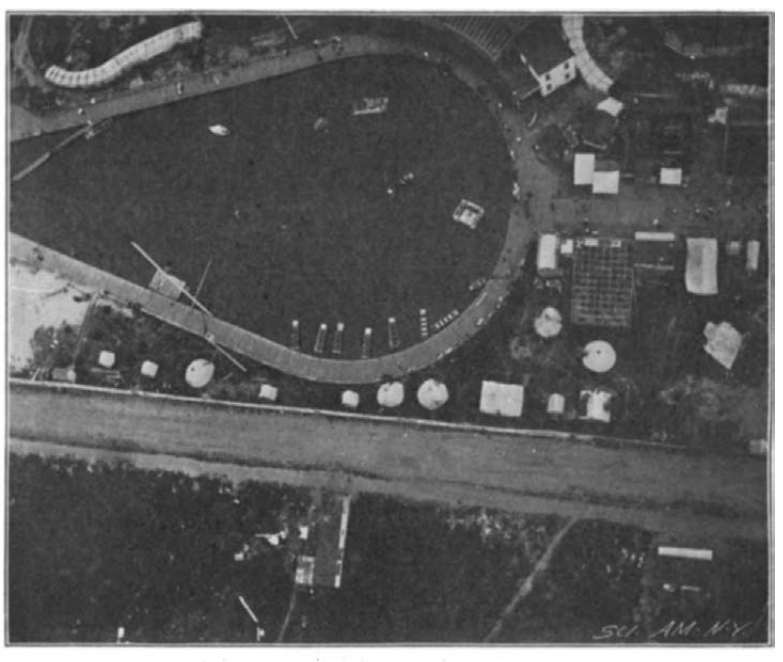
Working Platinotype Paper.

It is sometimes difficult, if one has not had considerable practice in the exposure of platinotype paper, to obtain a satisfactory result upon the first trial. It often happens that the prints which have been judged sufficiently exposed give only gray tones upon development. The reinforcing bath given in the following formula enables one to strengthen the tone of the platinotypes if too weak.

A.	
Saturated solution gallic acid	50 c. c.
Saturated solution nitrate silver	2 c. c.
Acetic acid, crystallizable	10 drops.
Water	50 c. c.
B.	
Potassium chloroplatinate	1 gramme.
Phosphoric acid	15 c. c.
Water	600 c. c.

The prints are plunged into pure water, then into Solution A, until the desired reinforcement is obtained. During this time they should be constantly agitated. They are then washed in three different waters to which a small proportion of acetic acid has been added, and are toned in Solution B until a good black tone is obtained. The prints are then well washed as usual.

WEST BRIGHTON, CONEY ISLAND, FROM CAPTIVE BALLOON.

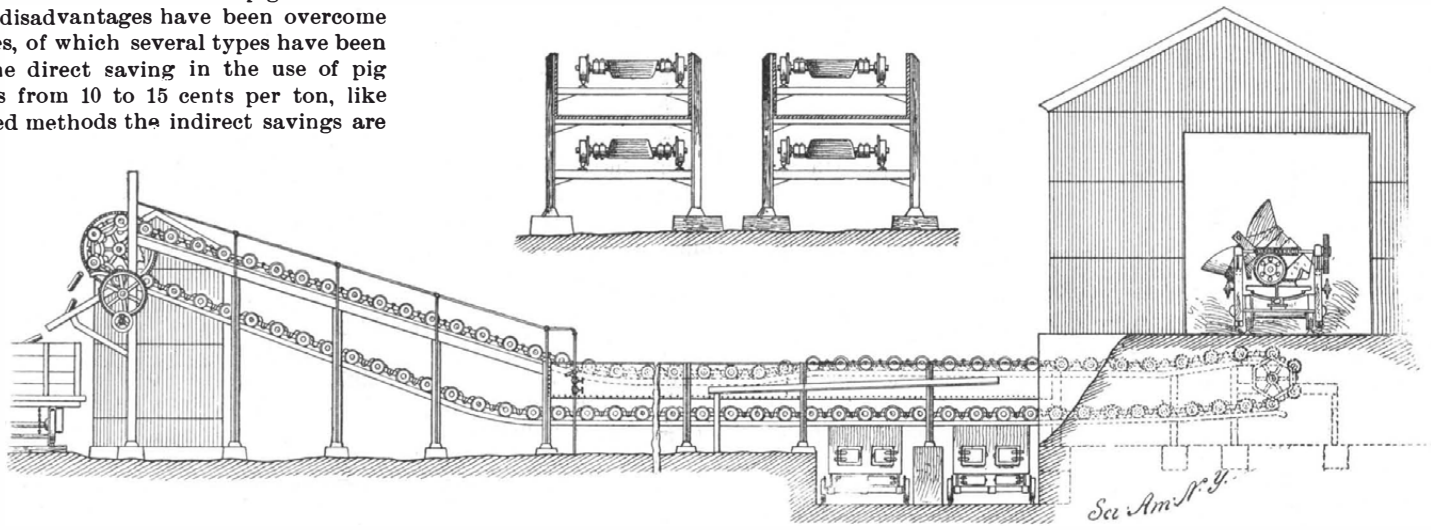


PAUL BOYTON'S "WATER PARK," AT CONEY ISLAND, FROM BALLOON.

THE amount of copper produced in the United States last year—estimating the output of December—was 264,600 tons. This amount includes the copper in sulphate, and shows an increase over the production of 1898 by about 10·5 per cent.

CASTING PIG IRON BY MACHINERY.

Among the many improvements in blast furnace practice, one of the most recent and not the least important is in the method of casting the metal. Almost from the first inception of the blast furnace, and until recently, the practice has been to cast the metal in open sand molds on the floor of the cast house. This, however, entails enormous expenditure of physical energy to break the pigs from the "sows" and load them on the cars for transportation. Although some attempts have been made to perform this work by mechanical operation, such as by the introduction of traveling cranes to pick up the sow and pigs and carry them forward to a cracker, which broke the pigs off and dropped them into a railroad car, still at the time of the introduction of the casting machine, practically all of the iron made which was not used direct, was lifted from the floor and loaded by hand at a cost of 16 to 20 cents per ton. The work is of such a nature as to require considerable practice before a man became proficient, and it was a rather difficult matter to keep up a force of men for this work when there was a heavy demand for labor. The quite general adoption of the direct process in making Bessemer steel, by which the liquid metal during six days in the week was taken to the conveyers from the blast furnace by a ladle, still required the maintenance of a force of men to handle the sand mold pigs on Saturday night and Sunday. As it is not usual to operate a steel works on Sunday, the keeping of this force at such wages as they received in the cast house during the other six days, when performing only common labor, was a very large expense. Again, while the capacity of the furnaces in 1869 was from 50 to 100 tons per 24 hours, the capacity in 1899 is 200 to 600 tons per 24 hours. With this enormous increase in production it has become a serious matter to lift the iron from one cast before the next cast was ready to top off. The very large and increased demand of recent years for open hearth steel created a demand for pig iron free from sand. These disadvantages have been overcome by casting machines, of which several types have been devised. While the direct saving in the use of pig casting machines is from 10 to 15 cents per ton, like most other improved methods the indirect savings are very large. These will probably bring the total up to at least 20 cents per ton.



ELEVATION OF PIG IRON CASTING PLANT, WITH LADLE IN POSITION.

The machines shown in our engraving are built by Messrs. Heyl & Patterson, of Pittsburg, Pa., for the Cambria Steel Company, of Johnstown, Pa. One casting machine such as is illustrated will handle 1,500 tons in 24 hours, loading it on the railroad cars ready for transportation. In a plant where the direct process is used, the only increased equipment is in the casting machine, as the ladles in the furnace and the steel works are used during the week for transporting the liquid metal, and perform the same service on Saturday night and Sunday between the furnaces and the casting machines. There are, of course, several points to be kept in view in designing casting machine. Thus, the crystalline texture must be as good as that now cast on sand beds. The apparatus must be simple in construction, with few working parts, so that it will not be liable to get out of order under the rather severe usage to which it is necessarily put, and the machine should be capable of application to existing plants and should be operated by a small force.

The accompanying engravings give an idea of the arrangement of the plant. The apparatus consists of a steel frame combining a water tank and upper and lower parallel tracks, a pair of chains carrying pressed steel molds or pans into which the molten metal is poured from a ladle through intervening runners so arranged that the stream to two or more lines of the molds can be equalized. The iron is poured into the molds while they are traveling at such a level as to be partially immersed in the water, in which condition they continue to travel for a sufficient length of time to allow the metal to become "fixed:" for the molds should not be cooled too rapidly. They are then submerged and travel through the balance of the length of the water tank, by which the pigs are sufficiently cooled to allow of their being loaded on wooden cars. One of our engravings shows the water in the tank and the molds just passing down to be submerged. Our diagram shows the curve in the path of the molds to cause their submersion. On the end toward the head or discharge end the molds are carried up a considerable incline and are then ready to discharge their contents—the cooled pigs—into chutes, which convey the pigs directly to the cars. This grade may be made steeper if necessary to gain a greater height. The plant illustrated is a double one, but each conveyer is, however, entirely complete in itself. The first engraving shows the discharge end. The mechanism is very simple and consists of devices for keeping the train of molds in motion. A 14 horse power engine at the Johnstown plant actuates the two trains of molds by means of a pinion shaft, each pinion having a friction clutch, so that either set of molds can be operated at will. The ends of the track will also be noted. The wheels which run upon them are 8-inch chilled traction wheels. After the molds are inverted, they are carried underneath and over furnaces, as shown in our diagram, which shows the reverse position of the molds. The furnaces are mounted on cars so that they can be withdrawn in case the machinery has to be stopped. Coal, gas, or crude oil is used as fuel. The molds are still damp when they reach the furnace, so that a heavy deposit of soot adheres to the interior and the lips of the mold, the heat, of course, being sufficient to dissipate any remaining moisture. The makers say that owing to the deposit of carbon they are able to use molds with large overhanging lips, as the deposit of carbon prevents the iron which falls on the lip as it passes through the stream from adhering to, or coming to rest and chilling on, the lips. The pigs all discharge freely at the head end. There seems to be a considerable field for these machines, as they tend to decrease the labor expense and at the same time give an improved product.

The Grape Belt and Its Product.

BY WALDON FAWCETT.

Grape culture is one of the industries in which the prosperous conditions of 1899 have worked an immense improvement. For several years past the fruit of the vine has been practically a drug on the market, and all through the "grape belt" of western New York and northern Ohio the grapes were allowed to decay upon acres of vines simply because the prevailing prices would not compensate the vineyard proprietors for the outlay necessary for picking and packing the fruit and for the cost of the light baskets in which it is shipped.

Conditions finally became so bad that vineyards which a few years ago netted their owners a profit of $1,500 on a season could not be leased outright at $400 per annum. The present year has witnessed the beginning of the improvement. The more prosperous conditions prevalent throughout the country have of course been primarily responsible for this, but contributory influences have assisted. Notable among the latter has been a considerable decrease in the size of the crop, and the formation among the growers of associations for the mutual protection of interests and the maintenance of prices. There are in the "grape belt" perhaps a dozen different organizations of this character, but their object is a common one.

The "grape belt" may be said to extend from Silver Creek, New York, along the shores of Lake Erie to Sandusky, Ohio, although, to be sure, there are several breaks in this territory. In width it nowhere exceeds fifty miles, and throughout the greater portion of its extent has a breadth far less. The yearly product of this land of vineyards foots up in the aggregate to fully seven thousand five hundred car loads, and as the capacity of a car may be estimated at two thousand baskets, it will be seen that the season's harvest represents pretty close to fifteen million baskets, each weighing about ten pounds.

Although the harvest season is of comparatively brief duration, a vineyard to be made thrifty and profitable requires considerable attention throughout the entire year. The vines require looking after, and the ground must be kept in the best possible condition at all times. Vineyards range in extent all the way from five to half a hundred acres, and in the case of each a packing house is located at some point readily accessible from all parts of the tract.

Despite the low prices at which grapes are sold, the work of picking is accounted a fairly profitable job in the rural districts. Every person around the vineyard including all the members of the owner's family usually assist in preparing the crop for market, but a majority of the professional pickers are girls and women. These regular pickers are paid at the rate of one cent per basket, which is supposed to be equivalent to at least one dollar per day. New hands are usually hired on the piece work plan for obvious reasons, while the more expert pickers almost invariably demand it. Many of the latter will earn from $1.50 to $1.60 per day.

The women pickers wear short skirts, large aprons, gloves with the thumbs cut out, and large hats or sunbonnets. As a rule, the pickers work in pairs, each worker giving attention to one side of the row of vines, so that not a single bunch shall be overlooked. The women sit by the vines, either on boxes or on the earth itself, hold baskets on their laps and clip off clusters of grapes with small sharp scissors prepared especially for the purpose. No picking is done in wet weather.

The two enemies of the vineyard owner are decay and destructive worms. The former is not regarded as especially dangerous, for the reason that the grower can virtually prevent it by a system of spraying the vines in the springtime of the year. The process entails quite an expenditure, but it is of course economical in the long run. The worms constitute a more perplexing problem. The advent of the worm is of comparatively recent occurrence, and when the cultivators have had more experience with the pest, they may be enabled to devise some means to eradicate the nuisance. The worm falls from the leaves of the grapevines to the ground and then burrows downward, attacking the roots and sapping the vitality of the vine.

The 1899 crop of grapes was very light in Ohio, but proportionately heavy in New York State. The improvement in market conditions may be imagined when it is stated that the growers received for their grapes an average of nearly ten cents per basket, whereas a year or two ago grapes sold at retail as low as five and six cents per basket.

Three large railroad systems traverse the grape belt, and they have been instrumental to a very large extent in the development of the traffic to its present proportions. Grapes cannot be transported successfully in cars of the ordinary type, but require instead refrigerator or ventilated cars. After the loading of a car has been completed it is moved to what is known as an icing station, where the ice boxes are filled to overflowing before the car is sealed and sent on its way.

Many of the grapes are shipped west and south to points as far away as the Pacific coast and New Orleans, to say nothing of all the large cities in the country, and it is of course highly essential that the preparations for shipment be made with the greatest care. Too much heat will cause the grapes to fall from the stems, and of course any failure to get good dispatch in transportation makes the fruit practically worthless. Naturally, nobody wishes to shoulder any responsibility which belongs to some person else, and as a consequence the grapes are subjected to a most rigid inspection when they are placed aboard the cars, and another when the point of unloading is reached.

In view of these necessities it may be imagined that the car famine which has affected all industries during the latter half of 1899 has made its presence felt in an unusual degree in the grape country. In order to insure prompt dispatch, three or four hundred extra cars should be kept in reserve in the "belt;" but this has seldom been done during the season just closed. The problem in the grape-growing world for next season — and already it is under discussion — is whether "trusts" or individual growers shall control the output.

The Nobel Prizes.

Candidates for the Nobel prize for scientific achievements are being considered by the Swedish Academy of Science, at Stockholm, which must award the prize this year for the first time. Among the names already proposed are Prof. Roentgen, Marconi, Baron Nordenskjold, and Henri Dunant, the founder of the Red Cross Society.

Science Notes.

Sir John Lubbock has been honored by a peerage and has selected the title of Lord Avebury. He has certainly won the distinction by his studies and writings.

Paris possesses 80,000 trees in the streets and public places. There are 26,000 plane trees, 17,000 chestnut trees, and 15,000 elms, the remainder consisting of sycamores, maples, lindens, etc.

We regret to note the death of Henry A. Hazen, professor of meteorology and one of the chief forecasters of the Weather Bureau. He developed the psychrometer tables for the reduction of barometric readings to sea level and he devised various fittings for meteorological instruments. He was also a celebrated aeronaut.

To open a book properly, hold it with its back on a smooth or covered table. Let the front board down, then the other; now hold the leaves in one hand while you open a few leaves at the back, then a few at the front, etc., alternately opening back and front until the center of the volume is reached. If this is done two or three times, there will be no danger of breaking the volume.

Mr. Harry Wells, assistant professor of chemistry of Wesleyan University, has taken up a residence in Prof. Atwater's respiration calorimeter, which we have already described, and will remain there nine days. He will have a rest of nine days, and will then go back for another period of nine days. His food will be either mixed with alcohol or will be composed largely of alcohol during the entire time.

H. Thoms has detected in tobacco smoke a poisonous, oily substance which produces violent headache, trembling, giddiness, etc. By treatment with a 2 per cent potash solution a phenol-like body may be separated which has an odor resembling creosote. To the presence of this oil, the observed toxic effects of tobacco may be attributed, since it is known that those are not altogether dependent upon the proportion of nicotine in the tobacco.

The pine needles of South Oregon are being utilized. The needles are first boiled and then run between horizontal wooden rollers, which extracts the juice. This is called pine needle oil, which is supposed to possess medical properties. The pulp is used as a medicated material for upholstering, and is also said to be a good substitute for horsehair. It is said that insect pests will not live in furniture that has been upholstered with pine needles.

The general rules and regulations governing exhibits at the Pan-American Exposition, Buffalo, 1901, have been issued. The Government Board created by Congress has made provision for including in the government representation at the Exposition exhibits from Porto Rico, Hawaii and the Philippines. Adequate provisions will also be made for a splendid exhibit from Cuba and adjacent islands. One American nation and colony after another, and one State after another, has already declared its intention of being represented, making it now certain that this exposition will furnish manufacturers and producers the most auspicious opportunity they have had for developing their trade relations throughout the western hemisphere.

Fish scales are being utilized in France, where a chemist has discovered that the scales may be used in the manufacture of artificial pearls, and our consul at Lyons has found that the supply is inadequate and that there is an actual demand for large quantities of the scales in his consulate, where good prices are paid for them. The scales should be sprinkled with salt as soon as they are removed from the fish and packed in tin cans. Any specimens sent to Mr. Covert at Lyons will receive careful attention, and the results, with any suggestions that may be made, and particulars of price offered, will be duly reported. As the American sturgeon has the most beautiful and largest scales of almost any fish in the world, this may be of considerable importance to fishermen who engage in catching sturgeon.

The London Lancet has recently cited some instances where diseases were communicated by holy water, and many samples were taken from churches in different towns in Holland. The result was the discovery in most cases of abundant bacterial growth, with the occasional presence of staphylococci and other pathogenic forms. Two guinea pigs that were injected with the sediment from a font of a church in Amsterdam died in thirty hours. Mr. Bruns, of Arnhem, Holland, devised a means of completely avoiding contamination. The water is stored in a narrow-necked jar inverted in a shallow basin, so that the overflow from the jar ceases as soon as the water in the basin covers the neck of the jar. One end of a bent tube filled with hair is immersed in the water in the basin, and the other end overhanging the edge delivers a constant stream of small drops raised by the capillarity of the hair. All these parts are inclosed in an ornamental open case so that the congregation have merely to hold their fingers for an instant in the stream. The apparatus has been sanctioned by ecclesiastical authority.

Engineering Notes.

The annual dinner in memory of James Watt was held on January 20, at Glasgow, under the auspices of the Institution of Engineers and Shipbuilders of Scotland.

A company is buying lignite coal mines in North Dakota, says Public Improvements, and is arranging for the construction of plants to render this material a satisfactory fuel in the form of briquettes.

As far back as 1770, on a royal visit to Woolwich, a 12-pounder brass gun was filled twenty-three times with shot in a minute, sponging between each fire and loading with great safety. This surprised every spectator.

A new railway bridge is in course of construction over Loch Etive, at the Falls of Lora, in Scotland. When completed, its span of 500 feet will be the second largest in Europe, coming next to that, of the Forth Bridge. It is designed by Sir J. Wolfe Barry.

The Houston and Texas Central Railway has recently created the office of Chief Gardener, says The Railway Review, the incumbent of which will have charge of making and taking care of the depot grounds and flower gardens at all points along the line from Groesbeck and Dallas, Texas.

The paper famine in England is getting to be very serious. It is caused by the difficulty in getting wood pulp, by the rise in the price of coal, and by the enormous increase in demand and stoppage of supplies from America. The South African war has naturally increased the circulation of newspapers, so that they are now using from 20 to 100 per cent more paper in London than they were a few months ago.

According to the last report, the Pasadena Sewage Farm is yielding a considerable revenue. The total receipts are $3,029 in spite of a severe drought, and the total expense including labor and tools was $2,375, says The Engineering Record. There are 60 acres of walnut trees, 25 acres of alfalfa, 20 acres in oats, and 35 acres in barley. Thirty more acres will be set out with walnut trees of the soft shell species. There is some talk of planting corn and beets.

More than $100,000,000 worth of paper is produced in the United States annually. A third of this is used by the newspapers, and the wrapping paper used amounts to two-thirds as much as that consumed by the newspapers. About half as much is used to manufacture books as to print newspapers. Paper boards amount to 300,000 tons a year. Builders use 60,000 tons of paper and 45,000 tons of wall paper is produced annually.

The Dickson Manufacturing Company received an order a year ago from the South African Republic for five locomotives to be added to the Boer war equipment. They were completed and boxed for shipment when orders were received to postpone sending them until further notification. The engines were constructed specifically for use on armored trains and are built on the same lines as the locomotives which proved such effective aids to Kitchener in the Soudan.

Alfred Brandt, engineer and contractor for the Simplon tunnel, died recently. He had great experience in tunneling, being employed as a mechanical engineer for the St. Gothard Railway. He devised ingenious hydraulic drilling machines for use in the St. Gothard tunnel, and he was also employed as engineer and expert in other great tunnels. The Simplon tunnel, which is the greatest, and perhaps the last, of the Alpine tunnels, gave him an admirable opportunity for the display of his skill.

The Eighth International Congress of Navigation will be held at Paris, July 28 to August 3, and the programme is a most attractive one, dealing as it does with a large number of subjects which might at first not be considered germane to the work of a congress of navigation, such as the effect of regulation works on the regimen of rivers, especially inundations; the progress in feeding of canals; the utilization of natural navigable waterways, the latest improvements in lighting and buoying coasts and harbor entrances, port works, etc.

A bill creating a new cabinet office has been favorably acted upon by the House Committee of Mines and Mining. It provides for a cabinet officer to be known as the Secretary of Mines and Mining. He is to have entire charge of affairs relating to mines, and the Geological Survey will be placed under his care. The Secretary is to have the same rank and salary as other cabinet officers, and he is to have an assistant, who will have the same relative rank as the First Assistant Secretary of the Interior. Another mining measure which was acted upon favorably was for the establishment of mining experiment stations in each of the mining States somewhat similar to the agricultural experiment stations, and provides for a government geologist at $3,500 per annum, and an assistant at $2,500 per annum in the mining States. These officers are to furnish assays, conduct explorations of mining regions and issue bulletins for the public.

Electrical Notes.

Wire fences are blamed for damage to live stock by lightning stroke. The director of the Iowa Weather and Cropservice recommends the use of earth wires at intervals along the fences.

Almost all the towns in Siberia are having arc lights for street use and incandescent lights for houses, and the larger proportion of the people in Siberia have never seen gas, which they regard as an illuminant of a past age.

Telephone communication has recently been established between Berlin and Copenhagen by a direct line which is much shorter than the old route by way of Hamburg. The line includes a submarine cable thirty miles long. The cable is made up of four wires, two of which are for the telegraph service and the other pair for the telephone line.

A Boston inventor has invented an antiseptic apparatus for disinfecting razors, shaving brushes, etc. It consists of a conveniently shaped vessel which contains an antiseptic solution. Separated at some distance are battery electrodes connected to a battery and induction coil. Holders for razors, brushes, etc., perforated with holes, enter this antiseptic liquid. The articles are promptly sterilized with its aid.

At the Alexian Brothers' Hospital in Chicago there is an electric water bath, consisting of a heavy porcelain bath tub with copper electrode contact plates at each end, at the sides and in the bottom. These plates are seven in number and vary in size according to the part of the body with which they are designed to make contact. Both Galvanic and Faradic currents are supplied to the bath; an induction coil, etc., is provided, so that the current at 110 volts from the lighting mains can be used for electro-therapeutic work. The bath tub was illustrated in a recent number of The Western Electrician.

In a recent address before the Montauk Club, of Brooklyn, Mr. Charles W. Price stated that over $600,000,000 had been invested in electric lighting in the United States, and that the total horse power required in the electric lighting of Greater New York was not less than 200,000 horse power, and that in the last thirteen years since the birth of the electric railway there had been an expenditure of more than $1,700,000,000, and that now any one could travel by electric cars from Paterson, N. J., via New York, to Portland, Maine, with only three insignificant interruptions which collectively amount to less than fifteen miles.

The late Prof. D. E. Hughes left large sums of money to charities. It is a well-known fact that though born in London he spent about twenty years of his youth in the United States and he was educated at Bardstown, Ky., where he afterward occupied the chair of natural philosophy. He obtained his patent for the printing telegraph instrument in 1855, and it was put into practical use by the Western Union Telegraph Company in 1857. He then went abroad, and in ten years succeeded in installing his invention in the telegraph service of nearly all the European nations, says The Western Electrician. His induction balance and microphone were also important inventions, and he received many well deserved honors.

We have already referred to the new telephone system which is being added to the fire boxes in New York city. The system is being rapidly installed, and the work of all of the chief officers of the department at large fires will be much simplified. When an officer wishes to talk to the central office, he hangs the telephone over the door of the fire-alarm box by means of a wire bail attached, and inserts the plug in the tapering hole in a brass block within the box which connects with the wires of the circuit. The officer then signals to headquarters with the telegraph key and is answered over the telephone. This will greatly facilitate the work of battalion chiefs, who formerly could communicate only from the signal box with the telegraph key within the box. It is the invention of Henry F. Blackwell, Jr., chief of the fire-alarm telegraph bureau.

The court at the Pan-American Exposition will be lighted by over 100,000 incandescent lights of 8 and 16 candle power. This will offer a highly diffused illumination with no intense points of brilliancy. In fact, it will be a bright light without shadows. There will be an electric tower 300 feet, and in front and facing the court of fountains will be a niche 70 feet high and 30 feet wide. In this niche will be a most beautiful water display. A large jet of water will be broken into drops by an ingenious device and under the powerful electric lights focused on the jet these drops will appear as prisms permeated with color in limitless combinations. Designs are being prepared for electrical fountains, says The Electrical World. They will be used for the embellishment of the interior courts of the other buildings. Plans are also being considered for the illumination of the Grand Canal, which will have a stretch of several miles. Mr. Luther Stieringer is the consulting electrical engineer of the Pan-American Exposition.

THE ROUND-LAP BALE METHOD OF SHIPPING COTTON.

BY D. ALLEN WILLEY.

The preparation of cotton for the market by what is known as the round-bale process is an industry which practically had its inception during the cotton season of 1896–97, when about 4,000 bales of this kind were shipped from the South. During the season of 1897–98 the number was increased to 70,000, while during the calendar year of 1899 it is estimated that 175,000 bales were prepared by this process.

In the main the plan followed is what is known as the Bessonette, invented by an American of this name. The several companies operating in the United States vary but slightly in the mode of forming the bale. What is known as the Standard circular press is in operation in some parts of the Southwest. The press

PLANTATION TEAMS UNLOADING COTTON AT THE PRESS.

COTTON SHIPPED IN THE SQUARE BALE.

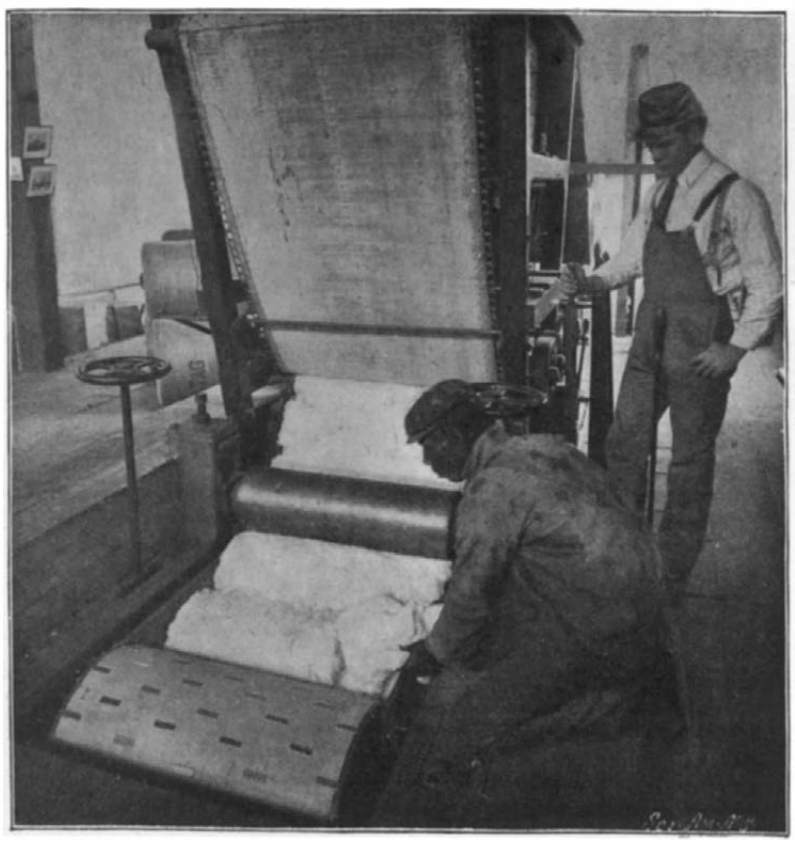
machinery proper weighs 6 tons and occupies a floor space 4½ feet square, with an arm supporting the screw shaft extending laterally about six feet from the press proper. In general a roller-press is operated by the baling-roll and endless-belt process. It is intended to be placed in a ginhouse and about twelve feet distant from the gin or gins. The cotton enters the top of the machine, passing between two belts operated on wooden rolls. The rolls and belts form a figure similar to the upper half of the letter Y, the lower ends of the trough formed by them gradually contracting until but a few inches of space are left for the cotton to pass through. By a movement somewhat similar to the carding machine in a spinning mill it is carried up into the bale former, as it might be termed, which revolves around an adjustable steel core. The endless belt of heavy metallic links, which is 25 feet long and 24 inches wide, operates two steel baling rolls which travel on carriages 7 inches long. These rolls, revolved by the belt, act in connection with the bale former, holding the cotton in place, gradually moving backward on their carriages as the size of the bale increases. As the baling winds around the core, the operator exerts more pressure on the rolls by means of the chain. When the mass of cotton is 10 inches in diameter, the pressure is 13 pounds to the square inch of its surface, the total pressure exerted being 7,500 pounds to the bale at the finish. When the roll has reached the required dimensions, the covering, which is suspended in a wooden framework above the press, is released, and descending, is formed mechanically around the bale. The metal ties which have been adjusted to the cover before it enters the machine are fastened by what might be termed metallic fingers. The operator then lets down the front of the press, and the bale, ready for shipment, is rolled out. This press can be operated by 6 horse power when connected directly with a line shaft and will take the product of six cotton gins when operated at its maximum speed.

The Standard press is quite similar in appearance to the one used principally in the Southeastern and Gulf States, which turns out what is known as the American round-lap bale. Like the Standard, it is attached to a condenser and bat former which take the place of the original condenser in the square bale press. The plant is attached directly to a series of from two to six or more gins, the condenser being connected with what is known as the lint flue, delivering the cotton as it comes from the gin to the bat former beneath it. The former comprises two endless aprons mounted in V shape, 2 inches apart at the bottom and 5 feet at the top, their inner surfaces traveling downward. The space between these is closed at both ends by boards, forming a hopper which receives the loose cotton directly from the condenser, converting it into a bat of 10 to 12 inches in thickness and averaging 2¾ pounds in weight to the square yard. In a continuous roll the bat passes beneath the first compression roll, which excludes most of the air, while the compressed material is round around a steel core, which is $2\frac{7}{16}$ inches at the larger end, tapering to $1\frac{15}{16}$, so that it can be easily removed. The core constitutes the temporary center of the bale. which is formed by the revolution of two baling or compression rolls and the baling-belt which passes beneath the rolls and under the bat. The belt acts as a guide in keeping the bat of the proper dimensions, while it also keeps it from sagging down and rolling unevenly. The baling rolls are located 5½ inches apart in this press, so that in the process the bat is wound several times around the core by the belt before encountering pressure from the rolls. But one roll is adjustable, moving back and forth. It is regulated by a valve connected with a compressed air chamber and cylinder, allowing the pressman to exert whatever pressure is desired upon the exterior of the bale. The air in the chamber is compressed by hydraulic power, varying from 325 to 275 pounds per square inch in the smaller presses, and from 250 to 200 pounds per square inch in the larger size.

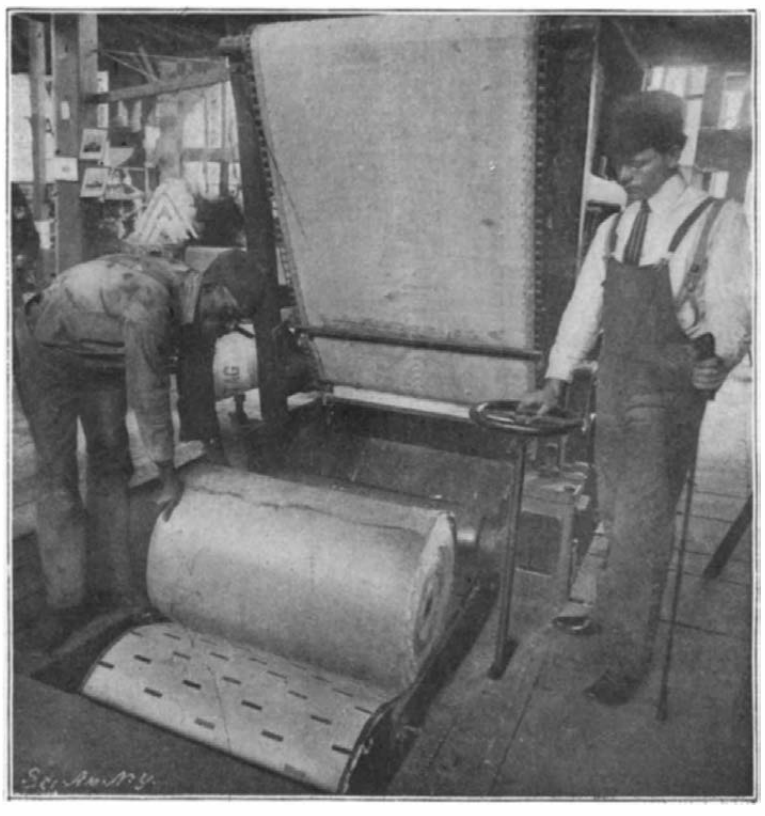
The winding continues until the bale is of the proper diameter, when a signal bell is rung automatically and the bat is shifted to the opposite side of the press and a new bale begun. The completed bale is lifted from the bed of the press by the attendants, the core knocked out with a mallet, and its covering stitched on. It is then ready for the market, with the exception of stenciling the weight, the press from which it came, and the address.

The majority of the round-bale presses in use in the South have bale formers on each side, and are so arranged that two bales can be prepared at once, the condenser being large enough to supply the necessary double bat. They are of two sizes, one turning out bales 22 inches in diameter and 35 inches in width, for export demand, and the other 25 inches in diameter and 48 inches in width, for American mills. The time required for the operation varies from 8 to 20 minutes, according to the rate of speed of the machinery. When running at maximum speed, 10 minutes will cover all of the work, including the wrapping and labeling.

A plant established in Weldon, N. C., in 1898, is a fair sample of the presses which are installed in the smaller communities of the South. This consists of a double press with the condenser and bat former connected with four Munger gins, each of 70 saws capacity. The machinery is housed in a wooden building 50 by 25 feet in dimensions and is operated by water power generated from one turbine wheel. The cotton loosely piled on wagons is driven under an open shed from which are suspended suction pipes of tin 12 inches in diameter. Exhaust fans suck the cotton into the gins, which remove the seed and a portion of the dirt and

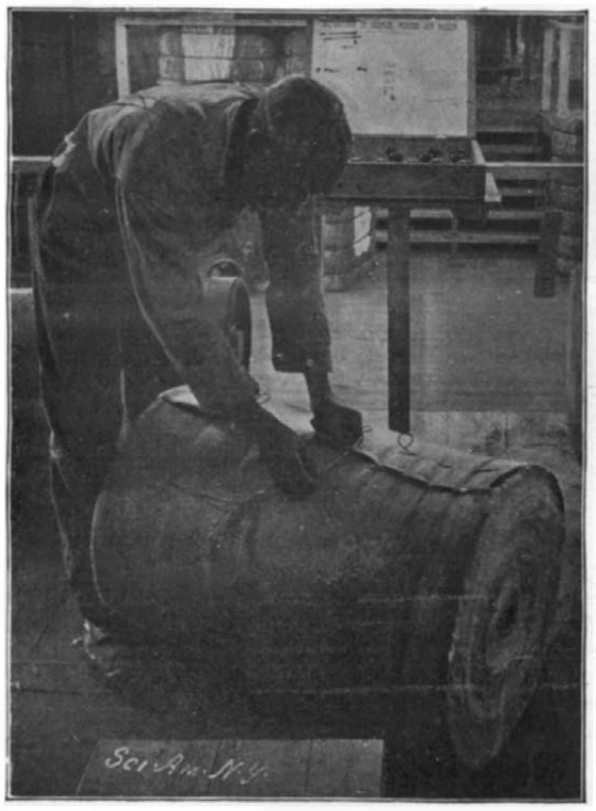


ROUND-BALE PRESS—COMMENCING A BALE.



ROUND-BALE PRESS—THE FINISHED BALE.

other foreign matter. From the gins the cotton is forced, also by air suction, to the condenser and press, where the bales are completed at the rate of 12 per hour. To operate this plant, 60 horse power is required, of which 35 is taken by the ginning machinery and 25 by the baling machinery. The manual labor required consists of a boy feeder, who merely directs the cotton into the suction pipes, a gin tender for the series of four, one pressman and two attendants, who

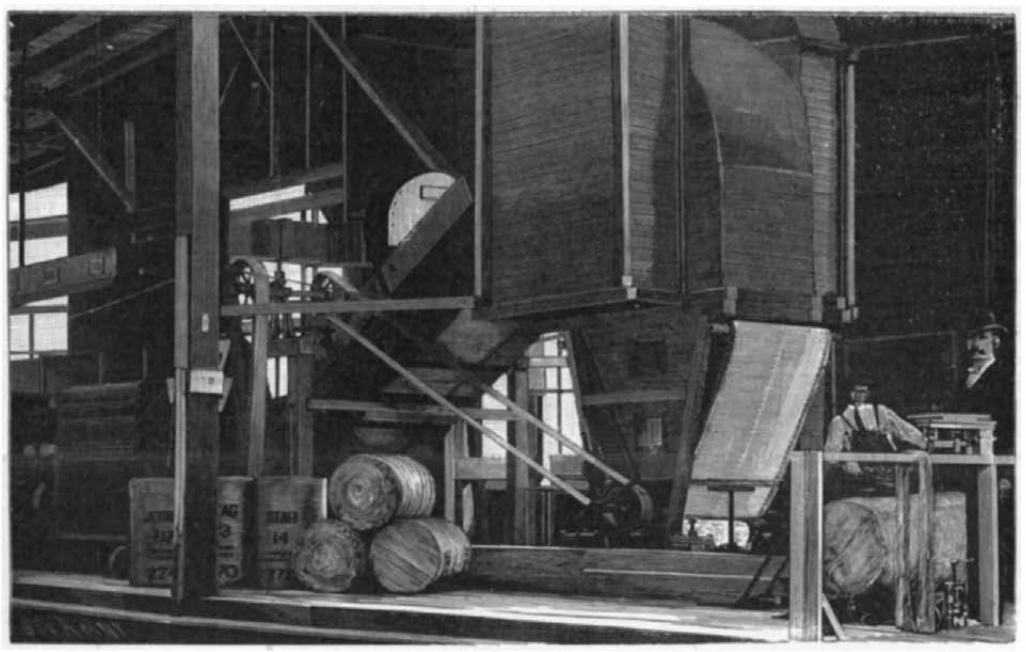


STITCHING THE BALE.

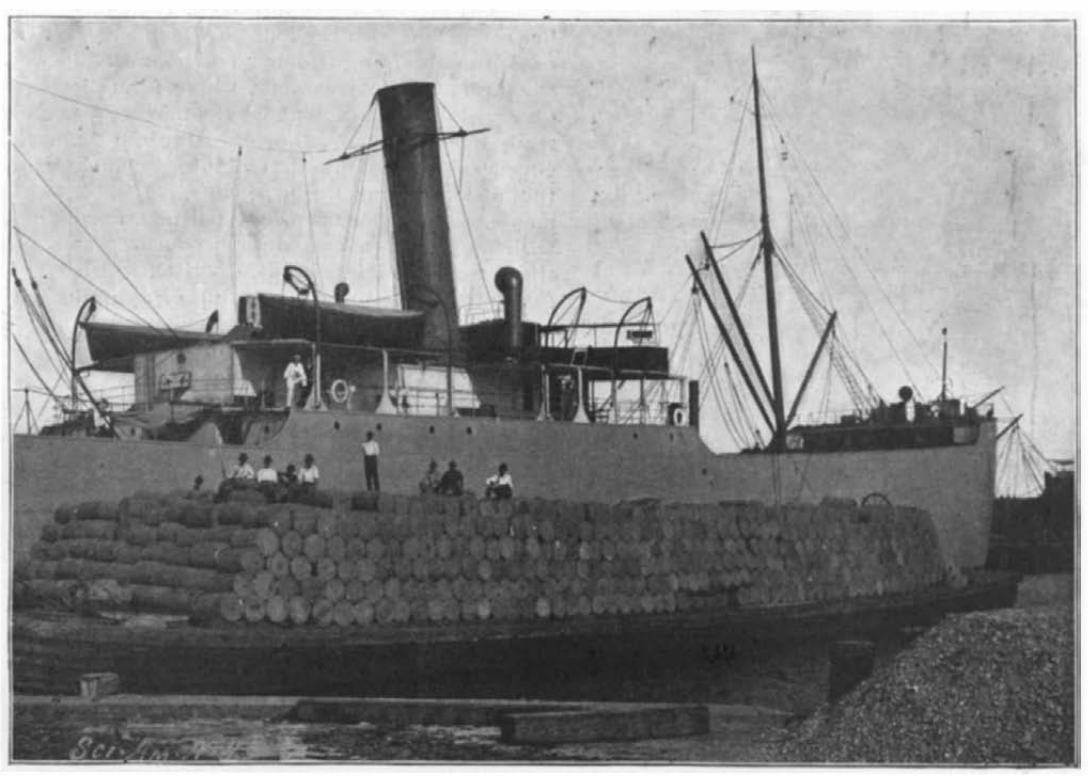
remove the bales from the press and stand by in case a belt should slip or something occur which would require the readjustment of any part of the machinery. In connection with the Weldon press is a cotton-seed oil mill, which converts the seed into liquid, hulls, and meal on the spot. The hydraulic power is applied by means of valves in the usual manner, while the press is controlled by a lever as shown in the illustration.

The advantages claimed for the round-baled cotton are that it economizes space; it is less liable to ignition; it is more readily handled in transportation and at the mill, as the covering is less liable to be damaged and the loss in this respect reduced to a minimum. The density of the American square bale is from 20 to 25 pounds to the cubic foot. A car loaded with square bales 54 inches long, 27 inches wide, and 16 inches in thickness will carry between 24,000 and 25,000 pounds. A cargo of bales pressed but once at the plantation will average about 13,000 pounds. The same size cars loaded with round-bale cotton have carried from 52,000 to 79,256 pounds. A carload containing the greatest weight has recently been received at Galveston, Tex. This is the largest quantity of the staple ever placed in one car. The density in the round bale ranges from 35 to 45 pounds per cubic foot, which is the same density as Egyptian cotton, considered the best square bale in the world. It is calculated that the round bale can be stowed on board vessels with a loss of but 9¾ per cent in waste space, while the expense of screwing, which is necessary in loading square bales, is done away with, saving from 30 to 40 cents per bale. The internal pressure in making the round bale reduces the quantity of air to such a small amount that it is claimed that the danger from "cotton fires" is reduced to a minimum, thus lowering insurance rates to cotton shipper and vessel owner. The size and form of the round bale allow it to be much more easily carried. As samples are taken of the cotton during the baling process, it is not necessary to open the completed package, as is the case with the square bale, to ascertain the quality, and the loss from the exposure is avoided. Other advantages claimed for the round-lap bale are that it can be fed directly at the mills without the necessity for rehandling, and that on the plantation and in the local market the time and labor necessary to sample, press, and compress it are entirely avoided, as well as the extra expense for metal bands or ties.

An objection urged against the round bale is that the pressure exerted to each roll is liable to crush the fiber and lessen its value at the mills. It is asserted that carelessness of the pressman may cause too much power to be applied. It has also been urged that grease and oil on the machinery will soil it unless the apparatus is kept properly cleaned, as the lubrication required includes portions of the press which are in proximity to the cotton.



INTERIOR VIEW, SHOWING ROUND-BALE PRESS FED DIRECT FROM THE GINS.



BARGE LOAD OF COTTON IN THE ROUND BALE.

Action of Lime in Arable Lands.

The Consulting Committee of Agricultural Stations and Laboratories has made the following communication, says Le Phosphate, concerning the action of lime in soils:

The requisite quantity of lime must be considered from two points of view:

1. As a fertilizer.

2. As a constituent part of the soil, modifying its physical and chemical properties.

From the view-point of the alimentation of plants, comparatively small quantities of lime may suffice, not materially exceeding the amounts of potash and phosphoric acid. Like potash, lime is a part of the vegetable products serving for forage and litter, and is thus returned to the soil with the manure. Slight dressings are sufficient to keep up the quantity of lime necessary for an average yield.

From the view-point of the chemical reactions of the soil, it is needful that there should be a considerable quantity of lime to thoroughly permeate the organic matter. The chemical reactions are especially the combustion of the organic matter and the nitrification and double composition with the salts of ammonia and potash, facilitating the absorption of these fertilizers by the soil. These various functions constantly transforming the lime to the state of bicarbonate, nitrate, sulphate, and chloride, require considerable quantities of calcareous matter in the soil in order that the proportion should not be materially reduced. The quantity cannot be stated definitely, but it ought to be the greater the more organic manures are used. Several hundreds of kilogrammes of calcareous matter disappear yearly from the surface of a hectare when the soil is moderately manured.

From the view-point of the mellowing of the soil, the rôle of the lime is not less important. It is known that there is an action on clays which reduces their plasticity and adapts them for acquiring the properties of arable lands. If the proportion is too small, special properties will predominate in the clay, and the lands will be stiff, less permeable, less fitted for utilizing the organic matter, and less easy to work. The proportion of calcareous matter which soils ought to contain is very variable, not only according to the proportion of the clay, but also to the fineness of the carbonate; less quantities are requisite if the division is extreme. The presence of sandy matter, which in itself tends to increase the permeability, may render more efficacious the action of a less proportion of lime. In soils containing a marked quantity of clay several hundreds of kilogrammes are needful. Heavy lands are often seen with considerable quantities of lime without the compactness of the clay being sufficiently effected.

For light lands this is not the case. In these the lime ought not to increase the permeability, since it is already too great. The lime should serve for giving them body, combining with the organic matter which they contain and forming calcium humate, whose agglutinating properties are well known. In such soils it is sufficient, having in view their physical properties, to supply a less proportion of lime. With the same quantities of calcium carbonate light lands are more calcareous than stiff lands; and when deficient it is not necessary to supply as much by liming or marling in the first as in the second.

In lands rich in organic matter it is requisite that they should contain sufficient quantities of lime to thoroughly saturate the humic matter, otherwise the lands would be moors and heaths, which in their natural state cannot be considered as arable.

From what has been said it may be understood that it is difficult to fix the limit to which the quantity of lime may be reduced, since the limit varies with the proportions of the other matters.

For light lands less than one per cent of calcareous matter is sufficient, while three or four per cent may be too little for stiff lands.

Chemical analysis is, therefore, insufficient to determine whether a soil has need of the application of lime. It is only in the case where it is absent or in very small proportion that this method of research may give reliable indications. But for soils containing nearly but not quite enough, it is practice and direct experimentation which must supplement the data furnished by analysis.

LANDSCAPE architecture is to be taught at the Lawrence Scientific School in a four years' course. The subjects taken up will include architecture, landscape design, surveying, study of plants in relation to landscape gardening, the construction of roads, water supply, drainage, geology, horticulture, drawing of contracts, etc. The subject is a very attractive one, and the results will be looked for with interest. The country, however, cannot support a very large number of graduates, though landscape gardening is a delightful profession.

India Rubber in South America.

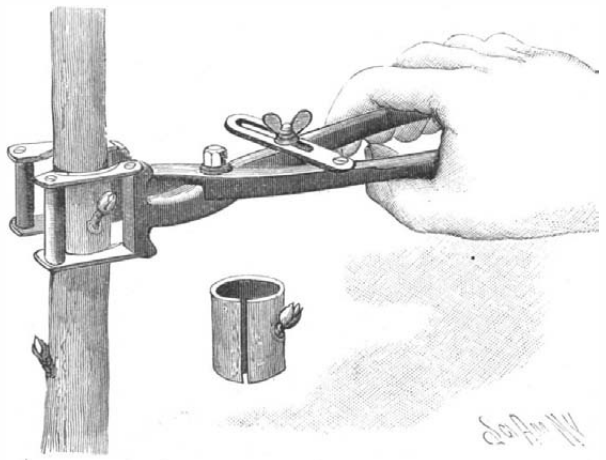
M. Eugene Poisson, who was sent by the French government to South America to examine into the India rubber question, has lately returned, and the official report which he gives presents many points of interest. The principal object of the expedition was to obtain information as well as seeds and plants, with a view of propagation in the French colonies. The city of Para, Brazil, was first visited; this is one of the great centers of the rubber industry, and the product found in the region is one of the most highly esteemed by the trade. To give an idea of the extent of the traffic in the region called Amazonia, it may be remarked that for the year preceding June 30, 1897, the fifteen principal houses have exported 22,300,000 kilogrammes of rubber, whose total value is estimated at $23,000,000. The Para rubber is taken from a tree belonging to the Euphorbiaceæ, genus Hevea, which grows in the damp earth on the borders of the numerous affluents of the Amazon. Divers species of this tree exist in different regions, giving different qualities of rubber; thus in lower Amazonia is found the H. Braziliensis, in the environs of Manao the H. discolor, and in the regions of the Rio Negro and Rio Naupes the H. pauciflora and H. lutea. In spite of efforts which have been made to determine the value of each of these species, this has been difficult, if not impossible, as it demands a prolonged sojourn in the humid forests which is not without peril for a European, as examples have shown. M. Poisson visited the forests near Para to observe the collection of the rubber. It appears that the natives distinguish two kinds of trees, which they call the white and the black Hevea, from the difference in the color of the leaves, the black giving the better quality of milk, but the mixture of the two seems to be superior to either taken separately. The hevea generally grows singly, and the seringueros, or sap-collectors, sometimes cover several miles in collecting the product. M. Coudreau, the explorer, has seen groups of trees on the banks of certain rivers, but very far from the main stream, generally in localities where it is impossible to stay on account of the clouds of mosquitoes found there. M. Poisson was able, after some difficulty, to secure samples of the milk for analysis, in well-corked bottles, but under the influence of the tropical heat fermentation often takes place. In the Amazon region the rubber is extracted by making a shallow incision in the bark of the tree with a small hatchet; below the cut is placed a small tin vessel held in place by its sharp rim, which is forced lightly into the bark. The contents of the buckets are emptied into a calabash and taken to the carbet, a small installation where the operation of "smoking" is carried out. This consists in dipping a blade of wood with a long handle into the milk, then exposing above a terra-cotta furnace in which burn small pieces of wood and the fruit of a certain palm called the attalea; the operation is repeated until a mass of sufficient size has been obtained, when it is detached by slitting one side. It is in this form that the rubber is delivered to commerce. The aim of this treatment is not only to evaporate the water and avoid putrefaction of the rubber, but the nut of the attalea possesses specific properties; analysis of the smoke shows the presence of acetic acid, which causes the milk to coagulate instantly, the creosote acting as an antiseptic.

The province of Ceara was next visited; here the rubber is obtained from a tree also of the family of Euphorbiaceæ, the Manihot glaziovi, which grows in dry soil; it is a tree of medium height—10 to 12 meters at most. Its milk is thicker than that of the Hevea, and it coagulates more rapidly. For this reason it is usually collected by allowing it to run down the side of the tree, where it dries in one or two days; it sometimes reaches the ground, becoming mixed with impurities. It is exported in several forms, either in balls or cakes more or less mixed with sand and debris, in globules formed by making light incisions in the bark, or in cakes prepared, like the Para rubber, by the fuming process, which is coming more and more into practice. As to the production of rubber in Ceara, no exact figure could be obtained; but according to the dealers, 400 tons had been produced in 1897. The governments of these two regions have endeavored to organize plantations by offering prizes, but with little success; the growth of the manihot is, however, very rapid, plants of five months attaining a height of 7 to 8 feet, and in one year, 12 feet. A third variety of rubber tree which merits attention is the Hancornia speciosa and its varieties, which give the rubber known as Pernambuco. It is a small tree bearing an edible fruit, which is sold in the markets. At Ceara, where samples of this rubber were seen, it was learned that it is nearly all exported to Liverpool; the quantity produced is, however, relatively small. M. Poisson had some difficulty in obtaining seeds; those of the hevea keep but a short time; the ceara varieties are more satisfactory. These seeds are greatly sought for by Americans, Englishmen, and Germans, but their collection must be carefully watched over, as the natives, suspicious of foreigners, will try to destroy their value, either by boiling or otherwise; 100,000 seeds of the hevea and 320,000 of the manihot were secured, with a loss of 30 per cent on the former, which should always be counted upon.

In the island of Trinidad was found the Miumsops balata, a magnificent tree of great height, and a diameter which sometimes exceeds 1½ meters. The product of this tree is greatly esteemed, but in the island the wood alone is used, its hardness and durability rendering it valuable. The Balata rubber comes usually from Venezuela or the Guianas, passing to Trinidad, which becomes its reputed place of origin. The incision made in this tree gives a milk which is very dense, flowing with difficulty; the coagulation is slow, requiring about twenty-four hours in the air. The government of Trinidad, which has a very fine experimental plantation, has been making trials of a Mexican rubber tree called the Castilloa elastica, with such encouraging results that a large plantation has been decided upon.—Abstract of report given to the French government by M. Poisson. Annales Telegraphiques.

A TOOL FOR TRANSPLANTING BUDS.

The device illustrated herewith is a tool invented by Duncan Galbreath, of New Orleans, La., by means of

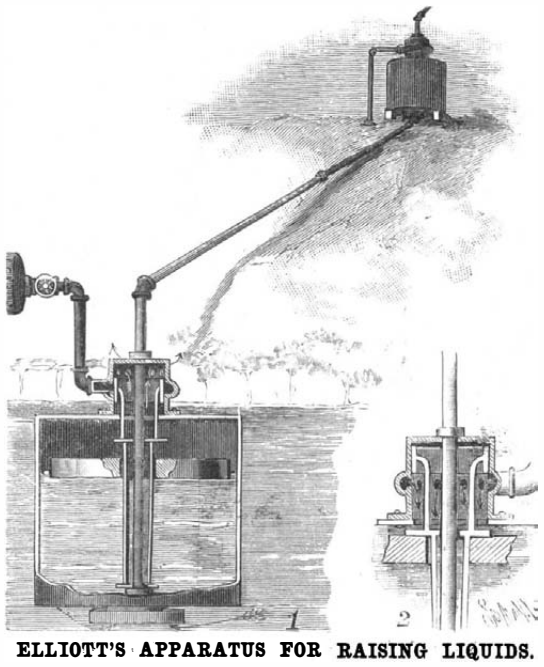


GALBREATH'S TOOL FOR TRANSPLANTING BUDS.

which buds may be transplanted without injury. The tool consists of two pivoted levers or handles, each having a cross-head upon one end. To each cross-head a pair of blades is screwed, formed with concave cutting-edges, so that when the handles are brought together, only the top and bottom portions will touch. The space between the blades is open so that the bud cannot be injured. The pairs of blades, constituting jaws, in effect are held in adjusted position by a link which is pivoted to one handle and which is made to receive a set-screw carried by the other handle. The jaws are fitted to the exterior of the limb, twig, or branch, the bud being midway between the pairs of jaws. After the blades have been closed firmly around the branch, and locked in adjusted position, the tool is turned so as to cut a sleeve or ring of bark from the branch, as shown in the small figure. The limb to which the bud is to be transplanted has a section of its bark removed by a similar tool, the space thus formed corresponding in length with the sleeve of bark carrying the bud to be transplanted.

AN IMPROVED APPARATUS FOR RAISING LIQUIDS.

To provide a device for raising water or any other liquid in which the steam or other motive agent used



ELLIOTT'S APPARATUS FOR RAISING LIQUIDS.

is automatically controlled, Mr. Ralph W. Elliott, of Oakley, Cal., has invented the apparatus represented in our illustrations. Fig. 1 is a partial section of the apparatus; Fig. 2 a detail. The apparatus consists of a vessel submerged in the water to be raised, and provided at its bottom with a self-closing and opening inlet-valve. The water admitted by the valve is discharged by a central pipe connected with the next vessel above, and provided at its lower end with a self-opening and closing inlet valve. The discharge pipe, as shown in Figs. 1 and 2, passes up through a cylinder superposed on the vessel and forming part of the valve for controlling the steam. The steam is led into the cylinder by a pipe connected with an annular chamber having openings leading to the outside of the cylinder. A second set of openings above the first serves to connect the cylinder and vessel with the atmosphere. A ring-shaped valve, alternately closing the two sets of openings, is provided with downwardly extending rods, having collars guided on the central discharge-pipe. Between the collars a float is mounted on the rods.

When the valves are in the position shown in Fig. 1, the steam or compressed air is cut off, and the water will flow into the vessel through the open inlet-valve at the bottom, causing the float to rise. As the float comes into contact with the upper collar, the ring-shaped valve is raised, closing the air-inlet openings, opening the steam-pipe, as shown in Fig. 2, and permitting the steam to flow through the annular chamber into the vessel to force the water up through the discharge pipe. As the water falls within the vessel the float sinks, finally touches the lower collar, thereby pulling the ring-shaped valve down, shutting off the steam, and opening the air-inlets. The steam under pressure passes out into the atmosphere; water again rises within the vessel; and the cycle begins anew.

The perfect automaticity of the operation constitutes the most striking feature of the invention.

A Gelatino Citrate of Silver Emulsion for Photographic Paper.

At a recent session of the Union Nationale des Sociétés Photographiques de France, M. A. Blanc brings out the fact that the formulæ for preparing the photographic papers of the citrate of silver type are little known, and he proposes to give a formula which he has found very good in practice, giving very clear whites with a great facility in toning. Before proceeding to prepare the emulsion proper, a preservative emulsion is first prepared according to the formula:

Alcohol, 90°	15 c. c.
White shellac	5 grammes.

Dissolve hot and pour rapidly into 100 c. c. of boiling water; filter through absorbent cotton. The yellowish-white emulsion thus formed will keep for a considerable time. To prepare the sensitive emulsion, he proceeds as follows:

SOLUTION A.

Gelatine, best quality	9 grammes.
Chloride of cobalt, 5 per cent solution	6 c. c.
Neutral tartrate of ammonia	2 grammes.
Citrate of ammonia	½ gramme.
Water	70 c. c.

This is to be placed in a porcelain receptacle of about 150 c. c. capacity; in a smaller vessel is placed—

SOLUTION B.

Nitric acid	2·3 grammes.
Distilled water	20 c. c.

After mixing, add 2½ grammes crystallized nitrate of silver.

The vessels A and B are placed in a water-bath and the temperature kept between 70° and 80° C. Each solution having been well mixed, B is poured rapidly into A, and to the emulsion which forms is added:

Alcohol, 90°	10 c. c.
Preservative emulsion	5 c. c.

Mix and filter through absorbent cotton: the emulsion is then ready to be applied to the paper. It should be used as soon as possible after preparation, as it will not keep longer than a few days. The paper, of course, may be kept for a long time without deterioration.

Copper Iodide Reactions.

M. Pozzi-Escot has lately given an account to the Academy of Sciences of a series of reactions which he has carried on with the iodides of copper; he has succeeded in obtaining two new compounds. These take the form of minute crystals, whose formation may be observed to advantage under the microscope. It is already known that if iodide of potassium is added to a cupric salt, a precipitate is obtained which is a mixture of iodine and cuprous iodide, Cu_2I_2. The experimenter has obtained the cupric iodide, in combination with ammonia, in two different forms. The first of these is the iodide, $CuI_2,4NH_3,H_2O$, which takes the form of small tetrahedral crystals of a fine blue color; it is obtained by treating an ammoniacal solution of copper by ammonium or sodium iodide. A second and rather unstable compound has also been obtained, which the experimenter supposes to be $CuI_4,4NH_3$. Its formation gives a fine reaction when viewed by the microscope. To a solution of a cupric salt is added a slight excess of ammonia; this is heated to 40° C., and a solution of ammonium or sodium iodide added. Under these conditions the liquid becomes yellow green and deposits fine rhomboidal crystals of a blackish-brown color, and sometimes orthorhombic crystals of an orange tint. These preparations, seen under the microscope, resemble the iodoplatinate of potassium, but the distinction is easy to make, and besides the crystals change their form and color rapidly. In 10 to 40 minutes, according to the conditions of the experiment, one finds only flat and short prisms and irregular crystals, whose color has changed to a light yellow-green.

THE XIPHOPAGES, ROSALINA AND MARIA.

Several months ago we published in the SCIENTIFIC AMERICAN an account of two little girls who were joined together in much the same manner as the Siamese twins. In the article we published at that time, we stated that "with radiography it will be easy to ascertain whether the two bodies are absolutely consolidated or whether they are independent. If the latter is the case, a surgical operation might be performed with considerable chance of success."

Through the kindness of a correspondent of ours, Mr. Eduardo Braga, of the College of Granbury, Minas, Brazil, we are able to furnish our readers with some recent data in regard to this phenomenon, and also to reproduce a radiograph which has been taken of these little girls. The sisters, Rosalina and Maria, were placed in charge of Dr. Alvaro Ramos, surgeon in the Hospital Misericordia, of Rio de Janeiro, and the communication made by him to the Academia Nacional de Medicina and the Sociedade de Medicina e Cirurgia of Rio de Janeiro, will be read with interest. Dr. Chapot Provost, lecturer of the Academia, is of the opinion, since the preliminary operation described in the report has been made, that it might be possible to perform a successful operation, but no such attempt will be made until the success of the operation can be more fully assured than is possible with the present knowledge of surgical science. Dr. Ramos, in the address of which we publish an abstract, says:

After the completion of the physiological experiments which proved the functional independence of the systems of Rosalina and Maria, I still had considerable doubts as to the nature of the tissues constituting the union of the two trunks, and as to the organs that might be found there.

At the last radiographic exposures, which formed the experiments of Roux and Balthasar,* strong doses of hyponitrate of bismuth were administered to the two girls, and owing to its opacity to Roentgen rays, this substance was revealed in the stomachs and in some of the intestine coils, thus proving that there is no connection of these organs in one abdominal cavity with those in the other.

Although I was much encouraged by this result, I still had no certainty as to the (possible) union of the livers, a point which could not be cleared up by the radiographs and to which my attention had always been directed, not only on account of the published results of five autopsies † in similar cases, including that of the celebrated Siamese twins, but further for terato-genetic reasons.

After making up my mind to try an operation, I diligently took all possible precautions, in order that, if the desired result could not be attained, the unsuccessful operation should at least have no disastrous effect; for this purpose, besides gathering around me colleagues of the highest ability, my companions in the daily work at the great school of the Misericordia (a Rio Janeiro hospital), I provided myself with instruments and materials to meet any emergency that might arise during the operation.

First I explained to them the plan I intended to follow. I proposed to begin with laying open the abdominal cavities; then to ascertain if all their organs were completely separate; and, finally, if the possibility of a complete separation was demonstrated, we should cut the cartilaginous ligaments which are at the base of the ensiform appendices and of the false rib; by preserving these ligaments until the end, we should insure the healing of the operative wound notwithstanding strains, in the event the operation could not be completed, as unfortunately turned out to be the case.

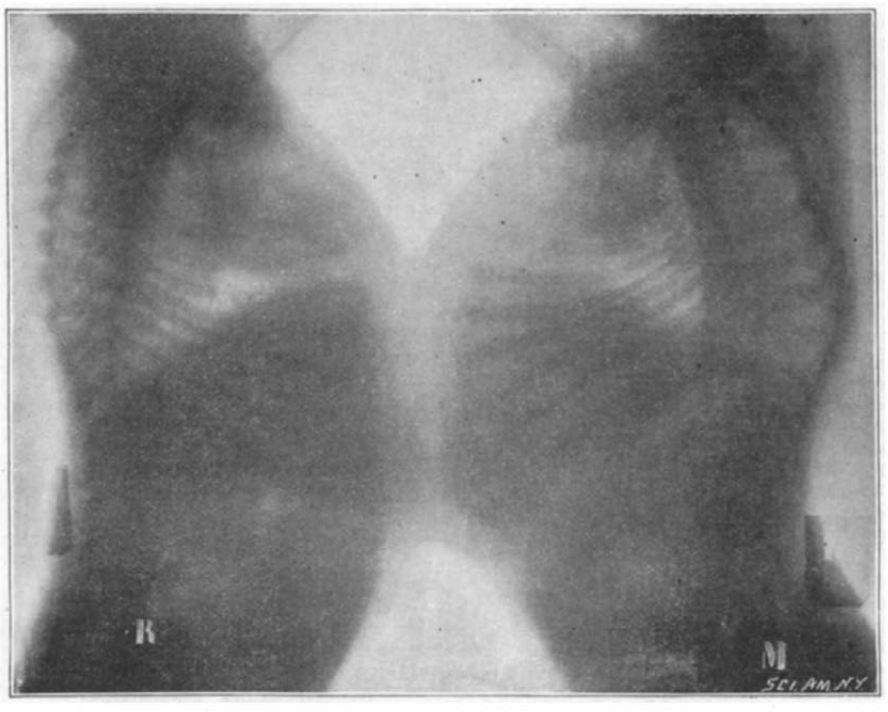
After fitting up two operating tables and the necessary appurtenances, and distributing the implements, Drs. F. Fajardo and Miguel Pereira were intrusted with chloroforming Maria, and Drs. Miguel Couto and Antonio Leão with chloroforming Rosalina. Fifteen to twenty minutes later, the two sisters were perfectly anesthetized, and laid on the first table—Rosalina on the right and Maria on the left; the side on which the thoraces were sunk in most was on top.

I began the operation by an incision of about six centimeters in the skin of the abdomen of Rosalina, a curved incision, with the concavity facing toward Maria, distant, at the half height of the connection of the two bodies, about three centimeters from the median line.

The skin having been folded over toward Maria, I found on the median line of the connection the separation of the two recto-abdominal muscles, the right one of Maria and the left one of Rosalina. After moving these aside, as well as the aponeuroses, I first met the fat pre-peritoneal tissue, and then cut through the peritoneum common to both cavities. This opening I enlarged by continuing the initial incision downward four to six centimeters, to the lower end of the connection, leaving the umbilicus on Maria's side. It then became easy to recognize the separation of the intestines and of the stomachs, and to thus confirm the result of the radiographic experiments of Roux and Balthasar.

Turning then my attention to the upper part of the incision, I discovered at once, through the very thin and transparent peritoneum, the dark color of the livers, partly covered by the cartilages of the sixth and seventh ribs. To further facilitate the examination, I continued the incision three or four centimeters upward, in the direction of the median line of the connection, and in doing this I was compelled to cut through the cartilages connecting the left seventh rib of Rosalina with the right seventh rib of Maria. The cut also passed through the lateral insertion at the left of Rosalina's diaphragm on the cartilage connecting the two ensiform appendices.

THE XIPHOPAGES, ROSALINA AND MARIA.



RADIOGRAPH OF THE XIPHOPAGES, ROSALINA AND MARIA.

Through this opening was plainly visible the bottom of Rosalina's left pleuro-costo-diaphragmatic pouch, and by putting the hand against the lower face of the diaphragm, one could easily feel the heart-beats in the direction of Rosalina's left side, which seemed to me to prove that her heart was not directed toward the right, confirming my previous opinion, founded upon the difficulty of auscultation on the left-hand side, and upon the entire absence of the kick of the apex.

Immediately below the diaphragms were the livers, united by the left lobes, which appeared to form a single body common to both livers, each of which had its particular gall bladder. At the height of the central line there was a suspending ligament, which, from its attachment to the connecting cartilage of the two ensiform appendices, extended to the common chamber of the two livers. In the hope that this ligament might be continued through the parenchyma of the livers, thus forming a septum separating the two lobes, I made an incision in this part of the common chamber, and to my disappointment, instead of finding a septum, I ascertained the continuity of the parenchyma.

I cannot indicate definitely the relative positions of all the other viscera, since the positions had partly been changed. I confined myself to ascertaining the extent of the surface connecting the two livers, and putting my right hand around them, with the fingers in contact with the lower or concave face, and the thumb over the convex top surface, I estimated that the surface to be cut would be about ten centimeters in length and three or four centimeters in width, corresponding to the thickness of the lobes at this point.

Such an operation with all the preparations for insuring hemostasia and the safe replacing of the livers in the abdominal cavity, in accordance with the latest methods of resection of the liver, would certainly require a quite considerable amount of time. This, added to the time already spent on the investigation, was more than these tender organisms could be expected to resist successfully, and every minute still further reduced their vital energy. I concluded to proceed no further. The wounds were dressed in the usual way, and after being awakened without difficulty, the two little girls were soon pretty lively and did not exhibit any great prostration, it being remembered that the loss of blood was very small, since not one hemostatic ligature was required.

Thus the double investigatory laparotomy was fully crowned with success. While I did not achieve what I had hoped I might possibly be able to accomplish, I have at least the satisfaction of having, without injury to the patients, ascertained the conditions of the problem, the best solution of which we have to seek. With surgical methods now known, the separating operation would have a fatal result unless there should be found a method of reducing the parenchyma connecting the two livers, or unless, at least, such a reducing or regressive process should be brought about by some mechanical means.

We desire to express to Mr. Braga our thanks for his kindness in sending us photographs and radiographs of the two sisters and the report of Dr. Ramos.

* Hartmann et Terrier. Chirurgie de l'estomac, 1899.

† Medical Times Philadelphia, Feb., 1874; The British Medical Journal, June 2, 1877, page 1273; Medical Press and Circular, Oct. 31, 1889, by K. Csaky Padolin. Weekblad van het Nederlandsch Tydschrift voor Geneskunde, No. 10 of 1887; Revue Medicale de la Suisse Romande, No. 2 of 1882.

Effect of Light on Chemicals.

An interesting phenomenon has been observed by Wilhelm Marckwald in connection with the change of color undergone by certain bodies upon exposure to light, without being otherwise altered in composition or structure. The anhydrous chloride of quinoquinoline, upon exposure to light, changes from a yellow color to an intense green, returning to its original state when heated to 90° C., or if kept in the dark for a few days at the ordinary temperature. This change of color is brought about in a few seconds by exposure to bright sunlight, and in a few minutes by diffused daylight; it is chiefly due to the more refrangible rays of the spectrum. No effect has been observed with the X-rays. A similar action has been observed with the body known as β-tetrachloro-α-ketonaphthalene, which crystallizes from its solutions, forming colorless and transparent crystals. These, when powdered and exposed to the light, change to an amethyst color; the large crystals upon exposure show a reddish violet color in one direction. These changes do not appear to be connected with a chemical or crystalline modification, and by fusion a non-sensitive modification may be obtained, which slowly returns to the sensitive form. To these phenomena the experimenter gives the name of phototropy.

SOME interesting experiments have recently been carried on at Chelmsford on signaling by flashlight from arc lamp projectors in the same way as is being done in Africa from Kimberley to the Modder River, and from Ladysmith to the camp at Chievely, says the English Electrical Engineer. It was found that the bright moonlight seriously hampered the signaling on one occasion. The height of the clouds also has a considerable effect upon the speed and ease of signaling.

Correspondence.

The Isthmian Canal Problem.

To the Editor of the SCIENTIFIC AMERICAN:

The editorial in your issue of the 10th inst. seems a little severe on the pending action of Congress upon the Nicaragua Canal problem. If any affront has been given anybody, it was given by Congress at its last session, when, without waiting for a report already being made, by a commission appointed by its authority, it ignored the work of the commission, then two-thirds completed and soon to be reported, and enlarged the commission by adding five members, thereby assuming that the Walker commission was either incompetent, or laggard, or both. This looks like an affront both to the President and the commission. "A decent respect for the opinion of mankind" should have allowed the commission to report before superseding them, and if Congress had been less hasty, the new commission would never have been appointed, for the Walker commission has thoroughly settled the question of the feasibility of the Nicaragua Canal and its extreme cost. No doubt $100,000,000 will cover the entire cost.

The commission has greatly enlarged on the Menocal plans, by an average prism nearly 75 per cent greater, has located the canal in the coastal plain and San Juan Valley, where it ought to be, puts the San Juan dam above the mouth of San Carlos River, which is the right thing to do, plans to regulate the lake level and locates the west side to the Pacific wisely and well. The great divide cut, the long and high embankments, the great dams and embankments at Deseado and La Flor, and the excessively high lift locks of the Menocal plans, are all wisely eliminated. What more can you ask? You say the great problem of regulating the lake level has not been solved. Well, what about the Panama project, where there is not a drop of water at the summit to regulate, and the tremendous freshets of the Chagres River have puzzled the engineers from the beginning, and the problem has not been solved to this day?

It is strange that you doubt the ability of our engineers to regulate the outflow of water from Lake Nicaragua, when the Chicago Drainage Canal is so easily regulated at pleasure by the rise and fall at will of the "bear trap dam," 160 feet in length. So too on the 3d page following your criticism of Congress, you exploit the "balanced cantilever" and show that a single machine handled 900 cubic yards in a day, raised it out of a cut 36 feet deep, and deposited it in a spoil bank 80 feet high. This is just the thing for the 12-mile cut west of the lake, quite similar in width and depth to the rocky portion of the drainage canal, and this is only one of the many ingenious modern appliances for handling material in wide and deep cuts. The commissioners add 50 per cent to drainage prices, for the excavation west of the lake, then add 6 per cent for administration, then add 20 per cent to that to make up their $118,000,000. Do you doubt that there are plenty of contractors that will be glad to do the work at those prices?

But suppose the canal costs $135,000,000, the highest that any authority has ever put the cost. Who would grumble? Nobody in this part of the dominion, I assure you. Everybody is unanimous for the Nicaragua Canal, and for its speedy construction, for it is by far our shortest route, and best route. Longer dilly-dallying is nonsense. No doubt that it will be of immense importance to the commerce of the United States and of the world, and as a paying investment it will outclass the Suez Canal. O. B. GUNN.

The Montague, Kansas City, Mo., February 12, 1900.

[We cannot agree with our correspondent in his suggestion that the appointment of the Isthmian Canal Commission before the presentation of the report of the Walker Commission was any reflection upon the latter body. The Walker Commission was concerned with the Nicaragua route and no other; whereas the President decided, wisely, as it seems to us, that before the country was committed to actual construction it would be prudent to determine which of the several possible routes was the best; and to this end the Isthmian Canal Commission was appointed. Such an examination is called for by the dictates of common prudence, and it is indorsed by everyday practice in the construction of our railroad systems, where several "trial lines" are almost invariably run before deciding upon a "final location."

The SCIENTIFIC AMERICAN desires to see the canal built and owned by the United States; but we want that canal to be the very best that can be built. So long as the location decided upon insures, more than any other, the advantages of short length, ease of access, permanence of structure, and low cost, we care not whether it is located at Panama, Nicaragua, or elsewhere at the Isthmus. That Nicaragua combines all these advantages, or that it combines them in greater degree than any other route, has yet to be proved. If the present Commission says that it does, we shall heartily welcome its immediate construction.—ED.]

Automobile News.

A new service of automobile cabs will be introduced in Paris.

Very satisfactory results are being obtained in Washington in the collection of mail from street letter boxes by means of automobiles. On one of the longest routes in the city the automobile covered the distance in thirty-two minutes, including twenty-seven stops. The regular collector's time for this trip is one hour and forty-five minutes, and with a horse-drawn vehicle one hour and twenty minutes.

The Current Supplement.

The current SUPPLEMENT, No. 1260, has many interesting articles. "Are Further Experiments Needed for Determining the Atomic Weight of Oxygen?" is by Edward W. Morley. "An American Pacific Cable" is the address delivered before the American Institute of Electrical Engineers by George Owen Squier, and is concluded in this issue. "The Electrical Potentiality of Atmosphere Referred to Other Conditions" is an interesting artcle by Professor Edwin G. Dexter, Ph.D. "The Man's Knife Among the North American Indians" is by Professor Otis T. Mason, and it is accompanied by seventeen illustrations. "The Cruise of the 'Albatross,'" by A. Agassiz, is concluded.

Contents.

(Illustrated articles are marked with an asterisk.)

Accumulators, test of..... 117
Aeronautics, practical progress in*..... 117
Automobile news..... 124
Bale, new cotton*..... 120
Books, new..... 125
Bridge building, record*..... 116
Buds, tool for transplanting*..... 122
Canal problem, Isthmian..... 124
Copper iodide reactions..... 122
Dish washing machine*..... 116
Electrical notes..... 119
Engineering notes..... 119
Gold, production of..... 114
Inventions, index of..... 125
Inventions recently patented..... 125
Lime, action of, on land..... 121
Liquid raising device..... 122
Mail matter, second class..... 114
Notes and queries..... 125
Nicaragua, level of Lake..... 115
Photographic paper, preparation of..... 114
Pig iron casting*..... 113, 118
Pipe line, Russian..... 114
Platinotype paper, working..... 117
Prizes, Nobel..... 118
Rubber, India, in South America 122
San Francisco Bay, problem of.. 114
Science notes..... 119
Stoker, mechanical*..... 116
Supplement, current..... 124
Wastes, power, utilization of.... 114
Xiphopages, the*..... 123

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CUT-GRAIN CARRIER FOR HARVESTERS.—HENRY BRYAN, Modesto, Cal. In headers the endless draper or apron runs on a roller arranged directly behind the sickle-bar and at a right angle thereto. The lower end of the roller, being near the ground, accumulates sand which increases the friction. To overcome this objection, the inventor forms the roller with a hollow, cylindrical body. Circular heads have a central interior and concentric interior flange fitted within, with a shoulder abutting the end of the latter. Coincident oil-holes are provided in the body and one of the heads to insure perfect lubrication.

COTTON-CHOPPER.—HENRY BARTELS and LOUIS BEENHARD, New Braunfels, Tex. This improved cotton-chopper can be readily attached to a cotton cultivator; the chopping knives can be easily secured at any desired place on the periphery so that adequate spaces are left between sets of knives for the purpose of passing over the stalks at desired intervals. The cotton-chopper comprises a wheel comprising connected disks, formed in their adjacent and inner faces with series of recesses undercut toward their opposite and outer faces. The chopping-knives have their ends fitted in the recesses.

MOWING-MACHINE ATTACHMENT.—THOMAS B. FAGAN, Van Wert, Ohio. This attachment is designed to be secured in the rear of the finger-bar of any machine for the purpose of gathering the grass or clover into bunches and discharging the bunches behind the truck of the mower, where they are out of the team's way on the next round. The gatherer consists of parallel slats turned up at their rear ends on a diagonal line. A gate is provided composed of an arm having pendent teeth or tines arranged along the line of draft parallel with the delivery side of the gatherer, the arm being made adjustable to be lifted from the gatherer to discharge the bunch of grass.

Electrical Apparatus.

ELECTRIC-LAMP SUPPORT.—HARRY LONG, Greentown, Ind. This device, composed partly of aluminum, is especially adapted for railway stations, hotel corridors, boulevards, and places where arc-lamp fixtures of tasteful design are required. The inventor has furthermore provided a very simple and ingenious means for supporting a lamp and for raising and lowering it, so arranged that upon lowering the lamp, the electric current is automatically cut off, so that the carbons can be renewed without danger.

Engineering-Improvements.

TRACTION-ENGINE.—AMBROSE M. SEARLE, Geneseo, Ill. The construction provides a pivotal connection for attaching one end of an adjustable two-wheel base to a traction-engine, thus making it possible to sustain the weight of that end of the adjustable base and also the weight of the load which may be carried upon that part of the base, at the same time allowing the engine perfect freedom in the movements as regards its steering or guiding apparatus and in the performance of its other operations. The action and position of the boiler of the engine control the guiding device of the two-wheel base. The base is so arranged as to travel in front of, instead of trailing behind the engine, as a result of the positive operation of the steering devices by the movements of the boiler.

MACHINE FOR MEASURING OR LAYING OUT SLIDE-VALVES.—PETER ELLIS and ARCHIBALD A. WHITELAW, Wellington, New Zealand. This improved device enables anyone readily to find, without further calculation, the angle of cut-off, the lead, and the linear dimensions of ports, the lap, and the angle of advance of the eccentric.

COMBUSTION-ENGINE.—JAMES L. BAILLIE and PERLEY B. VERITY, Shawnee, Ohio. This combustion-engine employs a driving-wheel of the turbine type and uses gas, oil, air, or steam as a motive agent. The gas, oil, or other element is used expansively, being ignited or exploded in a separate vessel, the resulting gases being conducted to the driving-wheel of the engine, thus providing a more steady and uniform pressure than when the elements are exploded directly within the engine.

Mechanical Devices.

SHEET-FEEDING MACHINE.—LEWIS E. MORRISON, Kensington, Conn. The invention provides a simple form of suction separating mechanism adapted to carry paper to the separating mechanism and the feed of the machine to which the attachment is applied. The mechanism automatically contracts and separates the lowermost sheet from a pile of paper and directs the selected sheet to any machine, device, or receptacle adapted to receive it and also effects such separation and delivery so that the paper is not buckled or subjected to undue strain or pressure.

FEED-ATTACHMENT FOR WOOD-PULP CHIPPERS.—SAMUEL W. BUTTERFIELD, Three Rivers, Quebec, Canada. The invention is a machine for reducing timber to chips, before transforming them by the aid of chemicals into wood-pulp. The invention provides a new and improved feed attachment for pulp-wood chippers for feeding timber to a revolving knife-wheel, for the knives to cut chips of uniform thickness, which is essential to a proper disintegration when the chips are subjected to the action of the chemicals to insure the production of a high grade wood-pulp.

FENCE-WIRE FASTENING DEVICE.—OSCAR D. WOODBURY, Rochester, N. Y. The inventor has devised an apparatus for fastening stays to the running-wires of wire fences. The fastening is effected by clenching a staple around the wires at their juncture and by slightly crimping the wires, so that the staple can more effectively engage and hold them in the proper relative position.

POWER-TRANSMITTER FOR WINDMILLS.—FRED C. THOMPSON, Burton, Wash. The power-transmitter comprises a wind-wheel loosely turning on a shaft. Independent ratchet-wheels are mounted to rotate loosely. A centrifugal governor is mounted on the wind-wheel and controls pawls adapted to engage either of the ratchet-wheels. Planetary gearing is driven from the ratchet-wheels and connected with and controlled by the governor. The power given to the shaft is transmitted by oppositely-arranged crank-arms to pump-rods to move the latter alternately in opposite directions, so as to insure continuous pumping. The operator can conveniently throw the wind-wheel out of the wind whenever desired.

CURRENT-MOTOR.—ROBERT S. THEALL, Fort Pierre, S. D. The current-motor is designed for the utilization of the power of a flowing stream, ocean-tides, etc., and comprises a float having a post at one edge, with a mast mounted to turn upon the post. A series of sweeps or rotating-arms extend from the mast over the float and water. Stays extend from the upper part of the mast to the outer end of the sweeps. Levers pivoted upon the sweeps carry buckets or vanes adapted to drop into the water. The levers extend above the sweeps to engage the stays as stops. An incline extends down from the float into the water and engages the vanes to raise them out of the water. The lower edges of the vanes have rollers engaging the platform and float and supporting the vanes during one-half of their revolution.

REVERSIBLE CLUTCH-MECHANISM.—FRANZ SCHNEIDER, Lawrence, Mass. The main object of the invention is to provide a device for connecting the axles and wheels of motor-vehicles so that the wheel can turn faster than the axle, nevertheless enabling the axle to engage the wheel to turn it positively when the speed of the axle is equal to that of the wheel. The device is made so that it can connect the axle with the wheel to turn the wheel either forward or backward, and that it can be set so as to be disengaged entirely from the wheel, enabling the wheel to turn in either direction.

Railway-Appliances.

CAR-BRAKE.—CHARLES E. SHARPLESS, Dubois, Penn. This brake is especially adapted for mine cars, but is also applicable to other vehicles. It is so constructed that it is capable of automatic adjustment or compensation for any unequal wear on the brake-shoes or blocks, thus obtaining equal pressure of the shoes or blocks at both sides of the car. The inventor claims that there is no friction between the brake-blocks and car-wheels when the brake is not in use, so that great pressure may be applied to the brake-blocks with but a slight expenditure of power on the operating lever.

Miscellaneous Inventions.

SKIRT AND WAIST-FASTENER.—WILLIS J. GALLUP, New Richmond, Wis. The invention provides a device for conveniently and securely fastening together around the waist the two sides of a placket of a lady's skirt and also for holding the dress-waist at the back. Thus the two parts of the dress are so connected as to prevent all unsightly gaping.

CHAIN-LINK.—WILLIAM H. GRIFFITH, Baltimore, Md. This wire chain-link is of that form in which there is a loop forming one end of the link, the other end being formed by two terminal eyes brought to lie side by side to receive through them both the loop of the next adjacent link in forming the chain. The present invention consists chiefly in locking the ends of the terminal eyes in convolutions coiled in the shanks at a point near the terminal eyes and at one end of the open portion of the link.

HORSE-DETACHER.—HENRY H. and GEORGE P. THOMSON, Wakarusa, Kans. The purpose of the invention is to provide a horse-detacher applicable to single or double rigs and arranged to permit the driver or other person almost instantly to detach a horse or team from a vehicle. The singletree is mounted so that it can be given a quarter-turn. Trace-pins are pivoted on the ends of the singletree and adapted to engage apertures in the trace. Keepers are carried by the singletree, each for normally holding a pin in position and allowing the pin to swing out of the keeper to release the trace upon giving a quarter-turn to the singletree. The pin is normally spring-pressed into engagement with the keeper.

HANGING CLOTHES-RACK.—LOUIS G. HORTON, Blossburg, Penn. When set up, this clothes-rack will accommodate a number of plain pieces, as well as skirts, shirts and the like, the latter named garments being suspended from the lower portion of the device. The clothes-rack is so constructed that the articles upon one tier will not interfere with the articles upon an upper or lower tier, the rack-bars or rods upon which the clothes are hung being arranged in graduated series.

LATHE-DOG.—WILLIAM B. HANKINS, Mount Vernon, Ohio. The inventor has devised an ingenious lathe-dog which can be readily fitted to all kinds of work, obviating, therefore, the necessity of changing the dog to suit the work. The dog consists of two jaws, which can be moved toward or from each other to engage and disengage the work. The saving effected by this device is obvious.

TOBACCO-PIPE.—EMIL P. DATOW, New Orleans, La. To prevent nicotin from passing to the mouth of the smoker, the inventor forms the bowl of the pipe with a smoke-outlet in its side above the bottom of the bowl. Into a cooling and draft chamber surrounding the bowl a smoke-outlet opens. A settling-chamber communicates with the bottom of the bowl, but is distinct from the cooling-chamber. An air-circulating chamber circulates air around the cooling and draft chamber. Saliva besides being prevented from passing to the cooling-chamber, repels the oil of nicotin.

BOOT OR SHOE HEEL.—JAMES J. NAUGHTON, Manhattan, New York city. One object of the invention is to provide an attachment for boot and shoe heels whereby the wearing-surface of a heel may be removed at will and another substituted whenever desired. The invention also provides for the attachment of a tread-lift of any desired character to a heel and supplies means whereby the lift may be detached from and secured to the shoe.

APPARATUS FOR DISTRIBUTING AIR.—JAMES CURLEY, Macoupin, Ill. This apparatus is adapted for application to vehicles, and is so constructed that air may be drawn and delivered directly to various points where it is required. When the vehicle is occupied, currents of fresh air will be supplied not only to the occupants of the vehicle, but also to the animals drawing the vehicle, the bodies of the animals being simultaneously protected from the irritation of insects.

SAFETY-LOCK.—JOSEPH M. ROBINSON, Manhattan, New York city. The lock is designed for attaching a window-cleaning device or belt to a window-frame or to another nearby support. The contrivance can also be profitably employed as a safety-lock. The device is constructed in two parts, one being designed for attachment to the support, and the other for connection with the cleaning-device. No springs are used in the construction. When once in position the lock cannot be released accidentally.

AUXILIARY GENERATOR FOR OIL-GAS LAMPS.—ALEXIS F. GILLET, Kearney, Neb. In using oil-gas lamps which have a generator heated by the

burner it is necessary ordinarily to furnish some means for heating the generator to volatilize the oil. The means usually employed consist of some form of torch for heating the generator when the lamp is first ignited. The object of the present invention is to provide a carbureter operated by the attendant, which will furnish a supply of carbureted air or gas sufficient to heat the generator to its working temperature. The device may be applied to any lamp of the form using a generator heated by the flame of the lamp.

Designs.

NECK-BAND FOR VESSEL-CARRYING DEVICES.—JOSEPH RITTENHOUSE, Philadelphia, Penn. The inventor twists a wire designed to fit a milk-bottle neck so that it will be provided with two eyes which receive the ends of a bail.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS ETC.

ELEMENTARY CHEMISTRY FOR HIGH SCHOOLS AND ACADEMIES. By Albert L. Arey, C.E. New York: The Macmillan Company. 1899. 12mo. Pp. 300. Price 90 cents.

The author has produced an excellent text book which compares very favorably with those of the same grade which we have examined. "Sulfur" never looks as well as sulphur, but it is perhaps well to bow gracefully to the new spellings, which seem to have come into chemical literature to stay. The diagrams admirably elucidate the text.

HOME PORK MAKING. By A. W. Fulton. New York and Chicago: Orange Judd Company. 1900. 16mo. Pp. 124. Price 50 cents.

The present volume is a complete guide to the farmer, the country butcher, and the suburban dweller in all that pertains to hog slaughtering, curing, preserving and storing pork product from scalding vat to kitchen table and dining room. The formulas are most practical. It is a work we can commend.

WATER AND WATER SUPPLIES. By John C. Thresh. Second Revised Edition. Philadelphia: P. Blakiston's Son & Company. 1900. Pp. 438. Price $2.

A thoroughly practical work of value to all sanitary engineers and to others who deal with water supplies. English practice is of course described; but attention has been given to the subject in England, owing to the density of the population, that it is all the more valuable on this account.

FORAGE CROPS OTHER THAN GRASSES. How to Cultivate, Harvest and Use Them. By Thomas Shaw. New York: Orange Judd Company. Illustrated. 1900. Pp. 281. Price $1.

The work has a practical ring about it that begets confidence. It will prove of immense value to every farmer who will give it careful study. Forage plants can be made to supplement perennial pastures. They are destined to occupy an important place in the near future in systematic crop rotation on every stock and dairy farm.

FORMULAS AND TABLES FOR HEATING. Being German Formulas and Tables for Heating and Ventilating Work for Those Who Plan or Erect Heating Apparatus. By J. H. Kinealy. New York: David Williams Company. 1899. Pp. 53.

This work will prove of value to all who have occasion to arrange heating and ventilating plants. Good work has recently been done in Germany, and we ought to receive the benefit of it.

THE DIURNAL THEORY OF THE EARTH. Or, Nature's System of Constructing a Stratified Physical World. By William Andrews. New York: Myra Andrews and Ernest G. Stevens. 1899. Pp. 551.

THE ART OF THINKING. By T. Sharper Knowlson. London and New York: Frederick Warne & Company. 1899. Pp. 139. Price $1.

A valuable little book which makes us see how defective we sometimes are in the art of thinking. It is an excellent book for every one to read, and all will be sure to be benefited by it.

ESSAYS ON THE FOUNDATION OF EDUCATION. By Rev. J. Godrycz, Ph.D. Lansing, Mich. 1900. 12mo. Pp. 168.

The author deals with "Intellectual Education," "Methods of Teaching History," "Religious Education," "International and Civil Law," "Moral Education," "Physical Education," etc.

CATALOGUE OF THE ANNUAL ARCHITECTURAL EXHIBITION, 1899–1900. Philadelphia: T Square Club. 1899. Small quarto. Pp. 210. Price 50 cents.

This handsome volume is filled with excellent architectural designs, both projected and actually executed. It shows what remarkable architectural work is being done in the United States.

SEEGER AND GUERNSEY'S CYCLOPEDIA OF THE MANUFACTURES AND PRODUCTS OF THE UNITED STATES. New York: The United States Industrial Publishing Company. 1899. 8vo. Pp. 1356. Price $10.

That the earlier edition has been in constant use in our office for some years in answering manifold queries as to manufacturers of all kinds of goods is a sufficient guarantee of the great excellence of the work. Its value has been demonstrated almost daily particularly in the consideration of cases where manufactured goods are made in small quantities or are of odd, out of the way articles. The arrangement is admirable, and access is rendered easy by means of a fine analytical index.

Business and Personal.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Ferracute Machine Co., Bridgeton. N. J., U. S. A. Full line of Presses, Dies, and other Sheet Metal Machinery.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 141 Varick St., N. Y.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remunerations.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7828) F. A. writes: I have read of a machine so constructed as to show the motion of the earth. It consists of a pendulum supported on a framework. How heavy would the pendulum have to be, and how long the rod to pendulum to construct a small model that would work with satisfaction? Could one be made with a pendulum weighing say three or four pounds and the rod about two feet long? A. The experiment is called Foucault's experiment from its inventor. The pendulum should be as long as possible, though with one 16 to 20 feet long you would probably succeed. The ball should be as heavy as convenient, ten to twelve pounds. A strong steel wire should be used to support the weight. The support at the top should be as rigid as possible. The space within a stairway several stories high is well adapted to the experiment. One was hung in Bunker Hill Monument, 222 feet high. The ball is made to swing exactly north and south, at the start. In even five minutes its deviation may be noticed, the south end of the swing falling to the west of the meridian. In this latitude the deviation is about 9 degrees in an hour. A valuable article on this topic is found in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 627, price 10 cents.

(7829) G. B. asks: What becomes of the latent and active heat contained in air or water when the oxygen therein combines with other substances, as in malting, fermenting, spontaneous combustion, putrefactive fermentation, in all which a rise of temperature takes place? Is not the latent heat the source of supply? And also animal heat, is it supplied by the same cause, that is, the latent heat supplied in oxidizing the blood? I am led to this way of thinking by the effect produced on air by depriving it of its latent heat; it becomes "liquid air." A. The heat given off when the various changes described above take place is due to the chemical combinations which occur. There is no liquefaction of the oxygen in any of these cases, but there is chemical action. This is a source of heat. The latent heat of air or water is given off when they change their state to the liquid or solid form.

(7830) W. F. asks: What magnifying power (number diameters) a microscope should possess to reveal spermatozoa and the consumption germ? A. For observing such objects, an objective of at least one-fifth inch focal length is required, and an eighth should be had if possible. The eighth inch with a 2-inch eyepiece gives a magnifying power of 425 diameters; with an inch eyepiece, 780 diameters; and with a half-inch eyepiece, 1,200 diameters. This is enough for any purpose.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

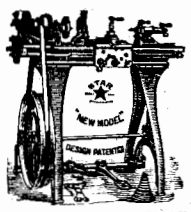
FEBRUARY 13, 1900.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acetone, preparing haloid derivatives of, L. Lederer 643,144
Acetylene generator, R. L. Beck 643,243
Acid, nitroamidoanthraquinone sulfo, O. Bally 643,451
Acids, purifying sludge, Waring & Brecke nridge 643,578
Addressing machine, envelop or wrapper, C. A. Belknap 643,394
Advertising coach, M. A. Michales 643,517
Air brake, C. L. V. Mundhenk 643,421
Air compressor, W. D. Hooker 643,135
Air purifying and drying apparatus, Birdsall & Krum 643,396
Alarm. See Burglar alarm. Fire alarm.
Automatic lubricator, R. S. O'Brien 643,303
Automobile fender, C. E. Belcher 643,370
Automobile vehicle gearing, L. H. Dyer 643,595
Back pedaling brake, H. S. Baker 643,450
Back pedaling brake, F. P. Hinckley 643,600
Bag. See Sample or conveying bag.
Bait, artificial, Votaw & Thomas 643,573
Banana shipping case, F. Schmitz 643,163
Banjo tailpiece, G. A. Rapp 643,159
Barrel locking mechanism, F. A. Hollenbeck 643,601
Basket stapling machine, J. C. Titus 643,568
Bearing, roller, H. B. Gillette 643,122
Bearings, cutting machine for making ball, K. Keyssner 643,381
Bed bottom, R. Schmidt 643,208
Bed, sofa, A. D. Tomlinson 643,210
Bedstead, B. R. Blaisdell 643,589
Belt fastener, A. L. Eaton 643,348
Bicycle brake, P. J. Parmiter 643,231
Bicycle crank shaft, W. H. Fauber 643,349
Bicycle support, J. Schirra 643,610
Bicycle support, E. J. Tierney 643,566
Bicycles, parcel rest and seat annex for, Gabriel & Atkinson 643,373
Binder, temporary, Kendig & Coleman 643,380
Blind slat adjuster, J. R. Morgan 643,361
Blind slat retainer, E. A. Thrall 643,565
Boat driving gear, J. A. Freund 643,490
Boiler. See Washboiler.
Boiler, E. J. Sabin 643,207
Bolster, W. F. Voss 643,572
Bookbinding, gummed cloth for, C. H. Crowell 643,594
Book rest, E. H. B. Hughes 643,188
Boring apparatus, deep, J. Vogt 643,428
Boring instrument, J. J. Tynan 643,260
Bottles, antirefilling device for, C. H. Whitaker 643,216
Box. See Match box. Paper box. Steam box.
Box fastener, A. Jarolimek 643,296
Box machine, G. Taggart 643,279
Box making clamp, W. L. Smith 643,551
Brake. See Air brake. Back pedaling brake. Bicycle brake. Car brake. Wagon brake.
Bridge gate, P. Gfroerer 643,407
Brush, H. Zias 643,441
Brush, fountain mucilage or paste, J. F. Walker 643,174
Buffing machines, apparatus for making abrasive covers for, Rogers & Winslow 643,235, 643,236
Buggy tops, mechanism for raising or lowering, C. R. Hesseltine 643,132
Bunsen burner for liquid hydrocarbons, R. Adam 643,097
Burglar alarm, J. T. Friend 643,405
Burner. See Bunsen burner. Gas burner. Hydrocarbon burner.
Burner, N. H. Bledsoe 643,105
Burning refuse, receptacle for, A. W. Cox 643,593
Button, A. Hall 643,409
Button, C. S. E. Spoerl 643,242
Button machine, N. Barry, Jr 643,585
Button making machine, N. Barry, Jr 643,586, 643,587
Button, separable collar, W. H. H. Wertz, Jr 643,579
Can cover, garbage, M. Fischer 643,489
Can washing machine, J. Des Brisay 643,479
Cane carrier, sugar, J. E. Tallet 643,558
Car brake, railway, G. S. Fanning 643,487
Car coupling, G. Arend 643,282
Car coupling, A. S. Martin 643,145
Car coupling, C. A. Tower 643,613
Car coupling, J. Willison 643,580,
Car coupling, O. Yates 643,582
Car coupling, automatic, E. Best 643,104
Car coupling for mines, H. Hughes 643,504
Car curtain, vestibule, T. H. Wickes 643,434
Car draft rigging, W. Case 643,590
Car fender, Porter & Barnes 643,199
Car side guard, C. J. Reilly 643,201
Car step, extension, B. E. Pines 643,155
Car wheel, noiseless, I. Hogeland 643,134
Carbureter, S. Broichgans 643,397
Carbureter, V. J. A. Rey 643,306
Carbureter, W. S. C. Russell 643,206
Carriage, motor, E. A. Sperry 643,257
Carriages, adjustable spring for baby, G. A. Smith 643,365
Carrier. See Cane carrier.
Cartridge belt, E. T. Gibson 643,495
Case. See Banana shipping case. Display and sample case.
Cask or barrel supporting apparatus, C. Lampitt et al 643,298
Casks or barrels, apparatus for pitching internal surfaces of, C. A. Neubecker 643,523
Caster, A. B. Diss ..... 643,481 to 643,483
Caster socket, G. D. Clark 643,468
Chair. See Rocking chair. Swinging chair.
Clamp. See Boxing clamp. Shaft clamp.
Clasp. See Strap connecting clasp.
Clay, porcelain, etc., machine for molding in, J. H. B. von Konigslow 643,417
Cleaner. See Dish cleaner.
Clevis, plow, W. G. Landers 643,510
Clock, electric, H. Iversen 643,506
Clothesline support, W. B. Robinson 643,160
Clothes pin, C. L. Prime 643,533
Clothes pin springs, machine for making wire, J. Drummond 643,224
Coffee pot, G. W. White 643,433
Controller, T. von Zweigbergk 643,442
Copying paper, moistening, F. G. J. Post 643,234
Corn popper, F. J. Becker 643,103
Corn sheller, W. C. Rowe 643,161
Cot, folding, S. T. Hutchinson 643,137
Cotton beater locking device, C. E. Smith 643,277
Cotton opening machines, lap roll tension for, F. H. L. James 643,295
Cotton press, H. M. Parker 643,152
Coupling. See Car coupling. Hose coupling. Thill coupling.
Cradle, swinging, J. F. Grimmett 643,267
Crate, folding, Taylor & Moore 643,562
Cream separator, W. J. Gould 643,351
Creamer, centrifugal, O. Anderson 643,218
Current meter, alternating, G. A. Scheeffer 643,162
Curtain pole, window, J. Lacy 643,142
Cushion fall stretcher, J. E. La Dow 643,297
Cut off and filter, automatic, M. M. Hitt 643,355
Cutter. See Fruit or vegetable cutter. Meat cutter. Paper cutter. Stalk cutter.
Dam, retaining wall, breakwater, etc., J. S. Fielding 643,488
Davit, ship's, J. W. McKinnon 643,197
Dental tool, for expressing mercury from amalgam, D. Aiken 643,443
Derrick, portable, J. B. Lord 643,360
Desk for hanging over the shoulders, reading or writing, H. Schnell 643,164
Digger. See Earth digger. Potato digger.
Dish cleaner, J. F. Parish 643,424
Disinfecting telephones, etc., device for, W. H. Taylor 643,309
Display and sample case, Underwood & Hawkins 643,570
Display holder, hat, S. E. Griggs 643,266
Door catch, M. J. Thuestad 643,612
Door frame and adjustable jamb therefore, S. S. Colt 643,399
Door lock, sliding, J. A. Eastman 643,245
Door, sliding, E. & A. Schmitt 643,307
Draft equalizer, two horse, G. L. Eason 643,404
Draw bar supporting mechanism, J. A. Yerk 643,315
Draw knife, I. S. Bailey 643,314
Drier, J. McCusker 643,149
Driers, apparatus for discharging water and air from cylinder, A. G. Paul 643,198
Drill. See Grain drill.
Driving mechanism, W. J. Thompson 643,564
Dye, from gallocyannin, blue, A. Steiner 643,338
Dye, red rhodamin, J. J. Brack 643,371
Dye, yellow acridinium, F. Ullmann 643,569
Earth digger and scraper, combined, B. F. Shuart 643,240
Electric distribution systems, safety device for, E. M. Hewlett 643,133
Electric energy, means for controlling and indicating the supply of, C. R. Loubery 643,228
Electric flashing switch, A. L. Cotter 643,401
Electric furnace, A. J. Petersson 643,254
Electric motor, Barker & Ewing 643,392
Electric traction motor, Richter & Eschler 643,276
Electric traction, surface contact stud for, W. Kingsland 643,414
Elevator, J. Fletcher 643,596
Elevator gate operated lock, J. Fletcher 643,598
Elevator safety device, J. Fletcher 643,597
Elevators, automatic safety device for, G. A. Newell 643,270
Engine. See Fluid pressure engine. Rotary engine.
Engine igniter, explosive, F. J. Macey 643,513
Envelope, E. E. Myers 643,333
Envelopes against surreptitious opening, method of and means for protecting, W. P. Horton Jr 643,376
Extension handle for culinary articles, P. Fromholz 643,292
Faucet for liquefied gas, measuring, W. F. Fritz 643,406
Feed stop mechanism, H. E. Harbaugh 643,599
Feeder, calf, I. H. Hall, Jr 643,287
Fence, L. S. Morgan 643,332
Fence, picket, L. Trabue 643,310
Fences, machine for weaving cross wires in, T. F. Carpenter 643,109
Fender. See Automobile fender. Car fender.
Filter, F. G. Kammerer 643,411
Filter, G. W. Woodworth 643,181
Filter strainer, O. H. Jewell 643,138
Filter, submerged, D. J. Bliss 643, 463
Filter, water, D. J. Bliss 643, 462
Filtering material, washing apparatus for, F. Sochurek, Sr 643,337
Fire alarm, pyroxylin automatic electric, J. de Froment 643,491
Fire escape, Walker & Horner 643,575
Fire escape device, E. P. Feiker 643,286
Fire extinguisher, M. E. Ogden 643,252
Fishing rod reel, T. Ross 643,538
Flail, S. R. Divine 643,186
Fluid pressure engine, A. H. Crockford 643,474
Fly exit for screens, H. N. Sheek 643,335
Fodder binder, J. T. Atkin 643,391
Folding table, D. W. Lloyd 643,511
Foods, coating, Lawer & Ruping 643,359
Form, garment, E. M. Schrader 643,543
Framing joint, E. E. Squires 643,552
Fruit butter, apparatus for making, F. Moss 643,362
Fruit or vegetable cutter, J. Blonde 643,106
Furnace. See Electric furnace. Heating furnace. Smoke consuming and fuel economizing furnace.
Furnace for baking enamels, glassware, and porcelain, A. J. A. Berthelier 643,458
Furnace grate, zinc, J. D. James 643,507
Furnaces, revolu ble grate for bagasse, Payne & Joubert 643,153
Furniture, B. R. Blaisdell 643,588
Game or puzzle, J. C. Teller 643,170
Gm esf dominoes, machine for keeping count of, J. W. Marler 643,515
Garment supporter, Bigger & Leonard 643,317
Garment tab, S. A. Saeger 643,238
Gas burner, F. J. Byrne 643,320
Gas burner cut-off, automatic, F. H. Oehlke 643,363
Gas burner, oil, G. T. Phelps 643,304
Gas burner, superheating, J. L. Campbell 643,466
Gas burning apparatus, S. W. Stott 643,259
Gas generating apparatus, acetylene, F. L. Rand 643,158
Gas generator, acetylene, H. J. Ennis 643,486
Gas generator, acetylene, G. F. Simpson 643,256
Gas generator, acetylene, Stewart & Updegraff 643,555
Gas machine, acetylene, J. Walton 643,576
Gas works valve, T. R. Beal 643,393
Gasometer, J. Walton 643,577
Gate. See Bridge gate.
Gate, U. A. Gregg 643,325
Gate, D. Miller 643,147
Gate, R. Rakestraw 643,157
Gate, J. P. Tarr 643,559
Gate, B. F. Warner 643,175
Gearing, electromagnetic variable speed and clutch, R. Kennedy 643,413
Generator. See Acetylene generator. Gas generator. Steam generator.
Glass plates, making concavo convex, Dhe & Houze 643,223
Glassware manufacturing machine, F. O'Neill 643,253
Gold washing machine, F. C. Pinnell 643,233
Grading machine, road, E. C. Fread 643,115
Grain drill, Ames & Labare 643,446
Grain drill gear, Ames & Labare 643,447
Grain drill shoe, detachable, D. J. Ames 643,445
Grain drill shoe, detachable, Howe & Labare 643,410
Grain drill shoe, detachable, N. M. Wig 643,435
Grinding mill, Kelley & Rouse 643,412
Grindstones, emery wheels, etc., roller for round picking, C. A. V. Hallgren 643,128
Gun, automatic machine, F. M. Garland 643,118
Gun mechanism, automatic machine, F. M. Garland 643,119
Halter, H. L. & C. M. Green 643,123
Hammer, drop, F. F. Bischoff 643,461
Hammock fan mechanism, E. B. & C. W. Brown 643,107
Handle. See Extension handle.
Harrow, tooth fastening, J. J. Callender 643,465
Harvester, J. J. Kennedy 643,227
Hay rack, E. Troy 643,211
Headlight, J. Kirby, Jr 643,141
Heater. See Hot water heater. Water heater.
Heating furnace, A. Laughlin 643,143
Heating plant, steam, J. D. Robertson 643,535
Hoisting machine, S. Mattson 643,516
Hoof protector, H. Gale 643,246
Hook. See Miner's bucket locking hook.
Horseshoe, cushion, H. Paar 643,272
Hose coupling, M. J. Konold 643,358
Hot water heater, W. K. Hopler 643,503
Hub, J. A. Cripe 643,185
Hydrocarbon burner, J. Johnston 643,602
Ice machine, plate, J. C. Kitton 643,269
Incubators, thermostatic governor for, M. M. Johnson 643,508
Indigo leuco compounds, manufacturing, A. H. S. Holt 643,502
Influence machine, H. E. Waite 643,367
Irrigation of arid land, L. L. Smith 643,550
Jars, bottles, etc., closure for, A. L. Weissenthanner 643,215
Joint. See Framing joint. Tube joint.
Knife. See Draw knife.
Lamp, acetylene, W. P. Crary 643,111
Lamp, acetylene gas, W. A. Barrows 643,101
Lamp, acetylene gas generating street, W. C. Clarke 643,222
Lamp burner, H. Greenwood 643,496
Lamp, fumigating, R. S. West 643,372
Lamp, incandescent, Rulon & Keen, Jr 643,425
Lamp, miner's, W. A. Dunlap 643,112
Lamp, pit or mining, R. C. West 643,281
Lamp shade, E. T. Berggren 643,395
Lamps, refracting attachment for bicycle, A. W. Hecht 643,129
Lathe apron, engine, W. E. Moffatt 643,194
Lathe bed and apron, W. Lodge 643,190
Lathe, crank pin or eccentric turning, Tindel & Albrecht 643,172
Lathes, speed changing gear for engine, W. Lodge 643,191
Leaf gatherer, R. Smith 643,386
Leather loop pressing machine, S. B. Beasecker 643,316
Linotype machine, D. A. Hensley 643,289
Linotype machine, Holliwell & Elliott 643,292
Linotype machine, J. MacKirdy 643,329
Linotype machine casting mechanism, J. Place 643,274
Liquid meter, Washington & Goodwin 643,432
Lock. See Door lock.
Locomotive, J. B. Tate 643,560
Loom, J. H. Northrop 643,271
Loom, H. Wyman 643,389
Loom harness, W. S. Lackey 643,509
Loom take up mechanism, A. W. Clement 643,287
Loom warp stop motion, R. Crompton 643,402
Loom warp stop motion, C. A. Littlefield 643,299, 643,300
Lubricator. See Automatic lubricator.
Mail bag gripping and delivering device, S. R. Patten 643,529
Mains, street box for underground, C. H. Campbell 643,106
Mangle, A. Kreuter 643,189
Match box, A. Fearnaught 643,350
Match machine, C. W. Steele 643,554
Match making machine, F. M. Clough 643,470
Match receptacle, I. H. Taylor 643,561
Match splint making machine, W. H. H. Sisum 643,546
Measuring and comparing illumination, apparatus for, J. Bijur 643,184
Measuring device, A. Janney 643,377
Meat cutter, E. F. Smith 643,547, 643,549
Meat foods, making, I. A. Timmis 643,567
Mechanical movement, A. J. Robinson 643,536
Metal bending machine, Henius & Herrold 643,353, 643,354
Metal hardening apparatus, C. W. Sponsel 643,278
Metal, table for hooping coiled, W. A. Cowles 643,472
Meter. See Current meter. Electric meter. Liquid meter.
Microphonic transmitter, G. F. Dupont 643,484
Mill. See Grinding mill. Tube or pebble mill. Windmill.
Mill, J. A. Peer 643,273
Miner's bucket locking hook, E. J. Richmond 643,534
Mining machine, C. Robinson 643,537
Motor. See Electric traction motor. Vehicle motor. Wave motor.
Motor operating plant, M. W. Quick 643,156
Mowers, adjustable ball bearing for lawn, J. Braun 643,318
Music holder, P. Bennan 643,456
Musical instrument, stringed, A. E. Bark 643,452
Musical instrument, stringed, A. Gunkel 643,125
Nail puller, W. L. Lubbock 643,512
Napping machine, D. Gessner 643,247, 643,248
Needle, self threading, Bunnell & Nichols 643,398
Nut lock, S. Harrell 643,500
Nut lock, J. A. Nickerson 643,615
Nut lock, D. Rhodes 643,364
Nut lock washer, E. L. Edmonson 643,485
Oven, baking, C. Rinck 643,202
Packing, R. C. White et al 643,341
Paddle wheel, J. S. Allison 643,444
Padlock, permutation, A. Amess 643,448
Paper box, F. T. Miyaji 643,420
Paper box, F. A. Stecher 643,366
Paper coating machine, W. H. Waldron 643,574
Paper cutter, J. E. Hill 643,374
Paper holder, roll, J. E. Hill 643,375
Paper manufacture, screen plate for, W. H. McCarroll 643,521
Paper or pulp vehicle tops, apparatus for making, T. W. McFarland 643,422
Phonograph, G. Bettini 643,183
Phonograph, T. B. Lambert 643,418, 643,419
Photographic dark room, portable, L. C. Cox 643,322
Phthalein in phenol, solution of, C. E. Gassmann 643,265
Picture, A. N. Polymath 643,275
Pin. See Clothes pin. Safety pin.
Pipe. See Tobacco pipe.
Pipe joints, clamp for repairing leaks in, C. M. Rankert 643,200
Planer, hand, F. Witzmann 643,313
Planing machine, E. Holmes et al 643,293
Planter, hand, C. Newman 643,524
Plate lifting device, F. S. Snyder 643,168

(Continued on page 126)



Star Lathes ★ Foot power Screw... ...cutting Automatic Cross feed

9 and 11-inch Swing.
New and Original Features
Send for Catalogue B.
Seneca Falls Mfg. Company,
695 Water St., Seneca Falls, N. Y.

AMERICAN PATENTS.—AN INTEResting and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

ENGINE & FOOT LATHES. MACHINE SHOP OUTFITS. TOOLS AND SUPPLIES. CATALOGUE FREE. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

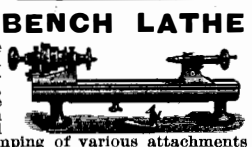
TOOLS Every kind of Tool for Steam, Gas, and Water Fitters. Every Tool has our personal guarantee. We have been the Leading Tool Manufacturers for Fifty Years . . .
WALWORTH MFG. CO.,
128 TO 136 FEDERAL ST., BOSTON, MASS.

A GRIP ON SUCCESS
can be obtained by having more knowledge than the man at the next bench. Don't stop work, but study "after hours," and we guarantee to fit you to advance rapidly in your business through our course of
EDUCATION BY MAIL
in Electrical, Mechanical, Steam, Mining and Civil Engineering; Metallurgy, Art, Architecture, Practical Newspaper Work, English Branches, Stenography, Machine Design and Mechanical Drawing. Low price: easy terms. Mention subjects interested in when writing to
The United Correspondence Schools.
154, 156, 158 Fifth Ave., New York, for catalogue 33.

NEW BINOCULAR.

(The Triëder.)
Small as an opera glass. More powerful than the largest field glass. *Send for Circulars.*
QUEEN & CO.
Optical and Scientific Instrument Works,
1010 Chestnut Street,
NEW YORK: 59 Fifth Ave. PHILADELPHIA, PA.

THE BEST BENCH LATHE

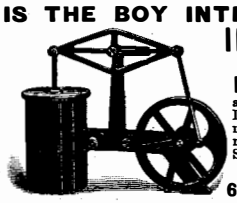


for precise and accurate work of all kinds is shown here in cut, and comprises Bed, Head Stock, Tail Stock, T Rest, Face Plate, Two Centers and Binder Bolt. Form of bed makes possible the clamping of various attachments without distorting the metal. Other special features that give general satisfaction wherever tried. For further and fuller particulars send for free descriptive booklet.
The Pratt & Whitney Co., Hartford, Conn.

The New Yankee Drill Grinder
Scientifically Correct
The only drill grinder ever made requiring but one preliminary adjustment. Gage Jaws, Chucks and other time-consuming apparatus **thrown to the winds.** Any clearance obtained instantly. Drills cut like razors. A boy can use it. **Iron Workers!** This machine will pay for itself many times each year. Correct work impossible without it.
Write us NOW while thinking of it.
THE FULLER MFG. CO.,
Successor to G. T. Eames Co.,
250 Asylum Av., Kalamazoo, Mich.

ACETYLENE APPARATUS
Acetylene number of the SCIENTIFIC AMERICAN SUPPLEMENT, describing, with full illustrations, the most recent, simple or home made and commercial apparatus for generating acetylene on the large and small scale. The gas as made for and used by the microscopist and student; its use in the magic lantern. The new French table lamp making its own acetylene. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1057.** Price 10 cents prepaid by mail. For other numerous valuable articles on this subject we refer you to page 21 of our new 1897 Supplement Catalogue, sent free to any address. MUNN & CO., 361 Broadway, New York.

IS THE BOY INTERESTED IN ELECTRICITY?



If so buy him one of our new
Electric Toy Engines
and he will be delighted with it. Double acting with parallel movement. Runs by batteries or lighting circuits. Strongly made. Sent prepaid on receipt of **$1.50.**
The J. JONES & SON CO.,
64 Cortlandt St., New York.

Buy Telephones

THAT ARE GOOD--NOT "CHEAP THINGS."
The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits. Our guarantee and instruments are **both good.**
WESTERN TELEPHONE CONSTRUCTION CO.
250-254 South Clinton St., Chicago.
Largest Manufacturers of Telephones exclusively in the United States.

DON'T LOSE THE POINT

of your pencil. Carry it in the **Improved Washburne Patent Pencil Holder.** Fastens to pocket or lapel of vest. Grips firmly but don't tear the fabric. Eyeglass Holder, with swivel hook, equally handy. By mail, 10c. each. *Catalogue of these and other novelties made with the Washburne Fasteners free for the asking.*

AMERICAN RING CO., Box P, Waterbury, Conn.

You spend thousands on coal bills—but how much to save the steam? Want to know more about it?—Ask for our booklet "H" on the HEINTZ STEAM TRAP.
WILLIAM S. HAINES CO.,
136 South Fourth St., Philadelphia, Pa.

Plow, rotary disk, M. T. Hancock	643,499
Pot. See Coffee pot.	
Potato digger and sacker, W. Kretzer	643,249
Power transmitting device, T. W. Heermans	643,130
Press. See Cotton press.	
Pressure regulating device, J. H. Ayasse	643,099
Printing attachment, combination roller, W. M. Pearse, Jr.	643,154
Printing device for paper roll holders, J. L. Bangley	643,369
Printing machine, G. R. Cornwall	643,372
Printing machine, B. H. Jordan	643,139
Printing press delivery mechanism, H. A. W. Wood	643,178
Printing press feeder, C. D. Mattison	643,384
Propelling mechanism for boats, hand, F. Burns	643,464
Puller. See Nail puller. Stump puller.	
Pulverizer, soil, J. F. Glidden	643,408
Pumping mechanism, G. W. McGill	643,150
Punching, shearing, and plow welding machine, combined, G. Sears	643,167
Rack. See Hay rack.	
Rail anchor, S. B. Anderson	643,449
Railway head gear cover, L. W. Penney	643,531
Railway signal apparatus, Gurr & Tomlins	643,498
Railway signal, electrically operated day and night, Saville & Winspear	643,255
Railway tie and railway fastening, Darby & Hooge	643,477
Railway track crossing, S. A. Friedsam	643,116
Railway train stopping device, C. Schutte	643,611
Railway trains, electric signal and automatic alarm for, J. K. Miller et al	643,148
Railways, system of distribution for electric, W. Chapman	643,283
Rake, J. L. Mackey	643,514
Ratchet wrench, W. M. Arthur	643,098
Refrigerator car ventilator, Kirby & Norling	643,328
Refrigerator wagon, E. W. Beyer	643,244
Register and advertising desk, Adams & Kane	643,582
Rivet setting implement, Thompson & French	643,339
Riveting implement, J. W. Thompson	643,340
Rocking chair, A. Lommatzsch	643,192
Roofing sheets, machine for flanging metal, F. E. Sagendorph	643,334
Rotary engine, L. Igelhorst	643,505
Rule, carpenter's, J. F. Rose	643,204
Sacking and weighing machine, A. M. Bates	643,102
Safety pin, G. Boden	643,261, 643,262
Salicylates of the yttrium group, A. Weller	643,280
Sample or conveying bag, O. Hoffmann	643,291
Sash fastener, E. M. Comstock	643,400
Sash fastener, W. S. James	643,356
Sash fastener, H. McGahey	643,195
Sash, window, I. N. Owens, Jr	643,151
Sawmill steam set works, R. F. Barker	643,453
Scale, automatic weighing, N. Nilson	643,423
Scale, coin controlled beam, W. H. Jordan	643,226
Scraper, F. Witzmann	643,514
Scraper, wheeled, W. C. Bradford	643,263
Screw cutting machine attachment, O. Sroka	643,553
Scrubbing machine, S. J. Clise	643,469
Seal, car, F. W. Brooks	643,345
Seal or trap for jars, etc., hydraulic, J. J. Moller	643,230
Sealing purposes, composition of matter for, G. McKay	643,251
Seam pressing machine, C. H. Bayley	643,455
Seed cleaning machine, A. A. Diffey	643,480
Separator. See Cream separator.	
Sewing machine, S. M. Jacoby	643,326
Sewing machine mechanism, M. Dendurent	643,478
Sewing machine stop motion, A. Steward	643,308
Sewing on buttons, machine for, Towns & Lynde	643,614
Shaft clamp, H. C. Swan	643,169
Sharpener, lawn mower, T. F. Herbert	643,290
Shears, G. B. Rowe	643,539
Sheller. See Corn sheller.	
Ships, means for elevating or lowering, Tentschert & Czischek	643,171
Shirt, J. J. Hagedorn	643,127
Shoe, A. Reed	643,607
Shoemaker's telescopic repair outfit, H. Waters	643,213
Shutters, means for closing or opening, W. J. Woodcock	643,217
Sickle, E. D. Woods	643,180
Sign, E. P. Gresh	643,124
Sign board, A. Block	643,219
Signal. See Railway signal.	
Signaling system, J. J. Ruddick	643,609
Siphon apparatus, I. L. Pendergraft	643,605
Skirt, adjustable, W. F. McGee	643,196
Skirt supporter, H. A. Heineman	643,268
Skiving machine, J. W. Fuller	643,494
Slate frame, M. A. Williams	643,177
Smelting auriferous antimony ores, Longridge & Holloway	643,301
Smoke consumer, J. F. Cody	643,110
Smoke consuming and fuel economizing furnace, W. L. Teter	643,563
Speculum, douching, L. J. Chapman	643,221
Spinning and twisting machine, W. Neubauer	643,302
Spinning and twisting machine spindle, H. F. Woodmancy	643,342, 643,343
Spinning machine, ring, Wiley & Connacher	643,436
Spirits in solid form, apparatus for producing, H. Hempel	643,131
Spool, B. G. Simmons	643,544
Spray attachment, R. Orford	643,526
Sprocket wheel wrench, C. H. Monroe	643,520
Stacker attachment, pneumatic straw, J. F. Lewis	643,383
Stalk cutter, S. A. Summerlin	643,556
Stamp, time, C. A. De Chapeaurouge	643,592
Starch, treating, C. B. Duryea	643,323
Stave jointer, J. F. B. Connell	643,471
Steamboat wheel, J. C. Mederer et al	643,146
Steam boxes, door for cannery, J. K. Rebbeck	643,606
Steam generator, G. De Roussy de Sales	643,541
Steam generator, G. H. Watson	643,368
Steam trap, F. Knackstedt	643,415
Stick pin retainer, G. J. Capewell, Jr	643,346
Stirrup, C. W. Percifield	643,232
Stove, J. H. Klipstein	643,382
Stove fireback, J. L. Williamson	643,388
Stove or furnace, heating, J. E. & J. Wormald	643,438
Stove water reservoir, Horsley & Rountree	643,136
Stoves, ranges, etc., fire box for, Warren & Nordell	643,430
Strainers to spouts of sheet metal vessels, attaching, C. L. Wagandt	643,387
Strap connecting clasp, J. V. Washburne	643,431
Stump puller, W. Bennett	643,457
Stump puller, J. Fletcher	643,187
Suspender attachment, apparel, M. J. Post	643,532
Swinging chair, C. H. Barrows	643,454
Switch. See Electric flashing switch.	
Switch, A. W. Rumsey	643,205
Table. See Folding table.	
Tank safety and alarm attachment, H. B. Fromberger	643,117
Tapestry or embroidery, producing on paper imitations of, E. Courbet	643,321
Target and automatic indicating apparatus, J. H. Van Viersen et al	643,173
Telegraph, printing, L. Kamm	643,379
Telephone telegraph, A. Sinding-Larsen	643,545
Telephonic repeater, J. Houlehan	643,225
Tellurian and lunarian, convertible, R. E. Grinstead	643,497
Textile machinery, roll clearer for, L. W. Penney	643,530
Theater appliance, I. M. Fuller	643,493
Thermally actuated mechanism, J. H. Bullard	643,319
Thermometer, pneumatic, Sanford & Brickham	643,542
Thermostatic apparatus, E. F. Woodman	643,179
Thill coupling, J. F. Tait	643,209
Thill support, R. T. Gillespie	643,121
Ticket, accident insurance and transportation, W. E. Watkins	643,214
Tie. See Railway tie.	
Tie holder, J. A. Mears	643,530
Tire inflation, air pump for, C. C. Clawson	643,264
Tire, pneumatic, A. A. Wade	643,429
Tire remover and setter, A. C. Palmer	643,528
Tire setting apparatus, rubber, G. W. Keller	643,357
Tires, composition of matter for repairing, O. P. Michael	643,518
Tobacco, machine for distributing flavoring matter upon, Lorillard & Tremaine	643,193
Tobacco pipe, A. C. Ladd	643,250
Tobacco truck, Dycus & Peay	643,324
Tool, combination, J. H. Garner	643,120
Tool fastening, R. Douglas	643,285
Top, spinning, C. Verniaud	643,311
Towing machine, F. Metcalf	643,331
Toy, H. Tamzarian	643,426
Toy figure, E. G. Newell	643,385
Tramway, elevated, Flory & Young	643,114
Trap. See Steam trap.	
Trap, E. F. Smith	643,548
Trolley, Holmes & Holland	643,501
Trolley hanger, mine, G. E. Jamme, Jr	643,327
Trunk and wardrobe, combined, Kobout & Rous	643,416
Tube joint, D. W. Caswell	643,591
Tube or pebble mill, C. L. Carman	643,220
Tubes to tube plates, connecting, O. M. Row	643,237
Tubing, F. F. Bischoff	643,459
Twine holder, W. P. Michael	643,229
Type setting machine, P. F. Cox	643,473
Typewriter, shorthand, J. F. Hardy	643,352
Typewriters, etc., escapement feed mechanism for, E. H. Dodge	643,403
Valve gear for engines, cut-off, F. K. Rittenhouse	643,203

(Continued on page 127)

PROFIT FOR MAKER ONLY

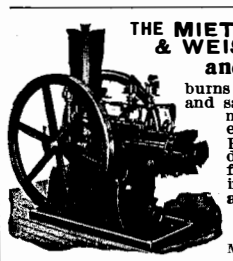
We manufacture 178 styles of vehicles and 65 styles of harness and sell them to you direct from our factory at wholesale prices. In fact, we are the largest manufacturers of vehicles and harness in the world selling to the consumer exclusively. When you buy on this plan you **pay only the profit of the manufacturer.** No traveling expenses, no losses, no agent's commission, and no dealer's profits.

WE HAVE NO AGENTS preferring to deal with you direct. We have followed this plan for 27 years. No matter where you live, we can reach you and save you money. We ship our vehicles and harness anywhere for examination and guarantee safe arrival. **We manufacture everything we sell,** and we can assure you of good quality from beginning to end; good wood work, good iron and steel, good paint and varnish, good finish, good trimmings, fine style and the largest selection in the land. **Large illustrated catalogue FREE.**

No. 180—Double Buggy harness, with nickel trimmings. Complete with collars and hitch straps, $22. Good as sells for $30.

No. 717—Canopy-Top Surrey, with double fenders. Price, complete, with curtains all around, storm apron, sunshade, lamps and pole or shafts, $75; just as good as sells for $40 more.

ELKHART CARRIAGE & HARNESS MANUFACTURING CO., Elkhart, Ind.



THE MIETZ & WEISS KEROSENE and GAS Engine
burns **KEROSENE** cheaper and safer than gasoline. Automatic, simple, reliable. No electric battery or flame used Perfect regulation. Belted or directly coupled to dynamo for electric lighting, charging storage batteries **and all power purposes.**
Send for Catalogue.
A. MIETZ,
128-138 Mott St., New York.
Markt & Co., London, Hamburg, Paris

BALL BEARING AXLES AND RUBber Tires.—A paper read before the Carriage Builders' National Convention, Philadelphia, October, 1894, showing the advantage to be derived from the use of ball bearings and pneumatic tires in road vehicles. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **992.** Price 10 cents. To be had at this office and from all newsdealers.

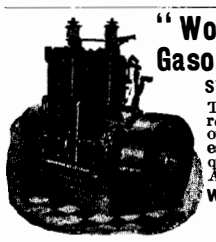
TO MINE OWNERS.

You need a **HOISTING ENGINE.** You want the best, strongest, safest, most up-to-date engine that is made—the most durable and yet the greatest saver of money. Send for our free catalogue and state the size of engine you want. We build them for mines, quarries, and docks. Both friction and geared hoist, 6 to 150 H. P. All parts easily interchangeable. Weber Gas & Gasoline Engine Co., 402 S. W. Boulevard, Kansas City, Mo.

HOIST WITH A WITTE HOIST

and you will get the greatest satisfaction. They are built specially for safe and strong work, and are always reliable.
Write for S. A. Catalogue.
Witte Iron Works Co.
1207 Walnut St., Kansas City, Mo.

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Details of furnaces for making the carbide, gas generators, gasometers, burners, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035, 1038, 1057, 1064, 1071, 1072, 1082, 1083, 1084, 1085, 1086, 1104, 1124, 1132, 1149** and **1150.** Price 10 cents each, by mail, from this office, and all newsdealers.

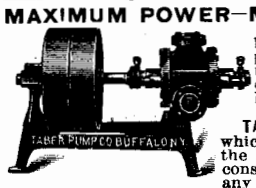


"Wolverine" Gas and Gasoline Engines,
STATIONARY and MARINE.
The "Wolverine" is the only reversible Marine Gas Engine on the market. It is the lightest engine for its power. Requires no licensed engineer. Absolutely safe. Manuf'd by
WOLVERINE MOTOR WORKS,
12 Huron Street,
Grand Rapids, Mich.

MERITORIOUS INVENTIONS
financed or patents sold outright. Capital furnished for good enterprises at 5 per cent. Stock companies formed and influential directors procured. Stocks and bonds sold. We transact all business on commission strictly. No advance fees. PETER WHITNEY, 100 Broadway, New York.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

MAXIMUM POWER—MINIMUM COST.



If you use a pump for beer, lard, acids, starch, petroleum, brewer's mash, tanner's liquor, cottonseed oil or fluids, hot or cold, thick or thin you want to get the
TABER ROTARY PUMP
which does the most work at the least expense. Simply constructed. Can be run at any desired speed. Perfectly durable. All parts are interchangeable. Needs no skilled workman. Defects guaranteed. *Catalogue free.*
TABER PUMP CO., 32 Wells St., Buffalo, N.Y., U.S.A.

COMFORT IN CAMP .·. and .·. ON THE YACHT
will be found in the use of
"Perfection" Air Mattresses,
PILLOWS and CUSHIONS.
When deflated can be packed in small space.
☞ *Catalogue sent on request.*
MECHANICAL FABRIC CO., PROVIDENCE, R. I.
LOS ANGELES RUBBER CO., LOS ANGELES, CAL.
Sole selling agents for California, Washington, Oregon, Nevada and Arizona.

See Our Exhibit at
SPORTSMEN'S SHOW,
Madison Square Garden, New York,
March 1st to 17th—Space No. 16.

SO SIMPLE A CHILD CAN USE THEM
SUNART CAMERAS
28 STYLES, PRICES FROM $5.00 TO $50.00
SEND 2¢ STAMP FOR ILLUSTRATED CATALOGUE.
SUNART PHOTO CO. 5 AQUEDUCT ST ROCHESTER N.Y.

CROOKES TUBES AND ROENTGENS' Photography.—The new photography as performed by the use of Crookes tubes as a source of excitation. All about Crookes tubes. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **181, 189, 238, 243, 244, 792, 795, 905, 908, 1050, 1054, 1055, 1056, 1057,** also SCIENTIFIC AMERICAN, Nos. **7, 8, 10** and **14,** Vol. 74. These profusely illustrated SUPPLEMENTS contain a most exhaustive series of articles on Crookes tubes and the experiments performed with them. Among them will be found Prof. Crookes' early lectures, detailing very fully the experiments which so excited the world, and which are now again exciting attention in connection with Roentgen's photography. Price 10 cents each. To be had at this office and from all newsdealers.

20th CENTURY ELECTRO VAPOR LAUNCH
This Ideal Gentleman's Launch, elegantly finished, simple, seaworthy, safe, reliable. Seats 8. Speed 6 miles. Guaranteed for one year. Price $200.00. Order now, avoid Spring rush. Send 10 cents for handsome 76-page catalogue of Steam and Sail Yachts, Launches, Row Boats, Canoes. **RACINE BOAT MANUFACTURING CO., Box D, RACINE, WIS.**

This beats Wind, Steam, or Horse Power.
We offer the **WEBSTER** 2½ actual horsepower
GAS ENGINE
for **$150,** less 10 per cent discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100 therefore we can make the price. Boxed for shipment, weight 800 lbs. Made for Gas or Gasoline. Also Horizontal Engines, 4 to 30 h. p.
Write for Special Catalogue.
WEBSTER MFG. CO.,
1074 West 15th St., Chicago.
Eastern Branch: 38-D Dey Street, New York City.
Southern Agents: Boland & Gschwind Co., Ltd., So. Peter and Lafayette Sts., New Orleans, La.

BUILD YOUR OWN ENGINE.

WITH OUR **CASTINGS**
GASOLINE ENGINES & LAUNCHES
COMPLETE READY FOR USE.
CATALOGUE FOR 4 STAMPS
GERE LAUNCH AND ENGINE WKS. GRAND RAPIDS MICHIGAN U.S.A.

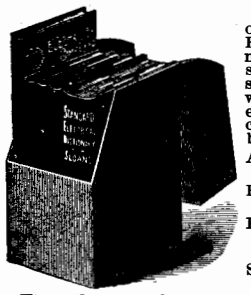
HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1182.** Price 10 cents. For sale by MUNN & CO., 361 Broadway, New York City, or by any bookseller or newsdealer.

FASTER THAN SHORTHAND!
One Stroke Prints a Word.
NO MORE MISTAKES.
No more illegible notes. You can become a stenographer at home in six weeks without a teacher.
Machines for the BLIND.

Anderson Shorthand Typewriter, 253 Broadway, New York.

FERRY'S SEEDS
Thousands of gardeners depend on Ferry's Seeds every year and never suffer disappointment. Cheap substitutes bring loss, not paying crops. It pays to pay a little more for FERRY'S SEEDS. Five cents per paper everywhere, and always worth it. **Always the Best.** 1900 Seed Annual free.
D. M. FERRY & CO., DETROIT, MICH.

A COMPLETE
Electrical Library
By PROF. T. O'CONOR SLOANE.



An inexpensive library of the best books on Electricity. Put up in a neat folding box, as shown in cut. For the student, the amateur, the workshop, the electrical engineer, schools and colleges. Comprising five books, as follows:

Arithmetic of Electricity 138 pages,	$1.00
Electric Toy Making, 140 pages,	$1.00
How to Become a Successful Electrician, 189 pages,	$1.00
Standard Electrical Dictionary, 682 pages,	$3.00
Electricity Simplified, 158 pages,	$1.00

Five volumes, 1,300 pages, and over 450 illustrations.

A valuable and indispensable addition to every library.

Our Great Special Offer.—We will send prepaid the above five volumes, handsomely bound in blue cloth, with silver lettering, and inclosed in a neat folding box, as shown in the illustration, at the **Special Reduced Price of $5.00** for the complete set. The regular price of the five volumes is $7.00.

MUNN & CO., Publishers,
361 BROADWAY, NEW YORK.

Study Engineering

TAUGHT ENTIRELY BY MAIL

One step at a time, with trained instructors and specially prepared texts you can become a railroad, electrical, structural, mechanical or steam engineer.

Write for free illustrated book describing these courses. It will point out one surely profitable way to employ your spare time. Fees moderate. Monthly payments if you desire.

NATIONAL CORRESPONDENCE INSTITUTE,
23-47 Second National Bank Building, Washington, D. C.

SENSITIVE LABORATORY BALANCE.

By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1184.** Price 10 cents. For sale by MUNN & CO., 361 Broadway, New York City, or any bookseller or newsdealer.

THE
ENGINEERING MAGAZINE
FOR 1900

will present a galaxy of notable papers, full of suggestion alike to student and practical man

A handsomely illustrated prospectus, with sample copy, free on request.

THE ENGINEERING MAGAZINE,
120-122 Liberty Street, New York.
222-225 STRAND, W. C., LONDON.

AN IMPROVEMENT AFFIXED ONLY TO THE SMITH PREMIER TYPEWRITER

SEND FOR NEW ART CATALOGUE
THE SMITH PREMIER TYPEWRITER CO.
SYRACUSE. NEW-YORK, U.S.A.

The Typewriter Exchange

1½ Barclay St., NEW YORK
124 La Salle St., CHICAGO
38 Bromfield St., BOSTON
817 Wyandotte St., KANSAS CITY, MO.
209 North 9th St. ST. LOUIS, MO.
432 Diamond St., PITTSBURGH, PA.
3 West Baltimore St., BALTIMORE, MD.

We will save you from 10 to 50% on Typewriters of all makes. *Send for Catalogue.*

THE GREATEST FAMILY NEWSPAPER IS

Leslie's . . . Illustrated Weekly . . .

It tells the story of contemporaneous events and illustrates it with the most artistic pictures. He who reads it every week learns to recognize the countenances of the noblest men and women in public and in private life; the appearance of the world's most famous places, and the scenes of the greatest historic interest.

LESLIE'S WEEKLY is a paper to keep on the library table, and to read and reread, and to file away for useful reference. It is read by more families of culture and refinement among the masses than any other paper of its class in the world. It is the greatest, best, most attractive and cheapest of all American educators.

It is for sale everywhere—on the stands, in the bookstores, on all trains, **at 10 cents per copy.**

One of the best general advertisiug mediums in the world. Send for rates.

LESLIE'S WEEKLY,
110 FIFTH AVE., NEW YORK.

THE HARRINGTON & KING PERFORATING CO.
PERFORATED METALS OF EVERY DESCRIPTION FOR ALL USES. 5 N. UNION ST. CHICAGO
SCREENS OF ALL KINDS.

Valve gear, steam engine, J. L. Zeigler	643,439
Valve hand wheel, F. F. Bischon	643,460
Valve, pressure reducing, W. C. Miller	643,519
Valve, rotary balanced, Orr & Booth	643,527
Valve, safety, F. Schreidt	643,239
Valve safety attachment, P. G. Van Wie	643,571
Valve slide, Carpenter & Watson	643,457
Valve, straightway, D. J. Crozier	643,476
Vehicle motor, A. Olson	643,525
Vehicle, motor, E. A. Sperry	643,258
Vehicle wheel, L. H. Zeigler	643,440
Ventilator. See Refrigerator car ventilator.	
Wagon box, R. A. Smith	643,336
Wagon box holder, W. A. Crotts	643,475
Wagon brake, S. T. Williams	643,437
Waist, apparel, A. S. Eveleth	643,113
Warming or cooling utensil, combined, C. F. Warren	643,212
Warp or weft threads, apparatus for scouring or equalizing, W. G. Andriessen	643,390
Washboiler, C. C. Jordan	643,378
Washing machine, J. Kissel	643,603
Washer. See Nut lock washer.	
Water closets, urinals, etc., receptacle for, S. W. Lewis	643,604
Water crane, Guy & Anderson	643,126
Water heater, J. E. Bancroft	643,100
Water wheel, C. H. J. Wiese	643,176
Watering troughs, automatic valve for, S. S. Templeton	643,427
Wave motor, C. F. A. Roell	643,608
Wave motor, S. P. Swearingen	643,557
Weeding implement, J. H. Schumacher	643,165
Wheel. See Car wheel. Paddle wheel. Steamboat wheel. Vehicle wheel. Water wheel.	
Whip stock, D. C. Hull	643,294
Winder, thread, D. G. Baker	643,583
Windmill, Sears & Currey	643,166
Window or transom corner post and bar, J. W. Coulson	643,347
Wire drawing machine, C. C. Baldwin	643,584
Wire stretcher, C. H. Snively	643,241
Wrench. See Ratchet wrench. Sprocket wheel wrench.	
Wrench, J. Hallner	643,268
Wrench, J. H. & C. C. King	643,140
Wrench, G. McKercher	643,522
Wrench, J. Rumery	643,540

DESIGNS.

Bath yoke, shower, E. Melchers	32,225
Bicycle fork crown, H. J. Pierce	32,235
Bicycle hub, A. P. Morrow	32,233, 32,234
Box, candy, M. Michaelis	32,212
Brushes, etc., back for, H. Hillbom	32,209
Cabinet, kitchen, F. J. Deli	32,238
Carpet border, A. M. Rose	32,244
Caster frame, G. D. & D. G. Clark	32,224
Chair back and seat, J. H. Coffman	32,237
Collar and necktie, W. O. Horn	32,241
Compressor frame, belted, E. B. Gallaher	32,216
Drill head, J. F. Barker	32,219
Eraser pocket, blackboard, B. F. Dunham	32,231
Furnaces, fire and combustion chamber for hot air, E. A. Klauss	32,222
Glass receptacle, W. R. Eliot	32,210, 32,211
Grinding disk, A. F. Davis	32,221
Grinding disk mill, A. F. Davis	32,220
Hoe, garden, W. H. McDonald	32,228
Hook, grass, Tilden & Earle	32,227
Hose support, lawn, I. R. Dotson	32,226
Ice crusher, F. K. Bobrer	32,230
Knife, putty, J. K. Jones	32,229
Link, J. Q. Adams	32,215
Nut lock washer, A. W. Reynolds	32,217
Pedal, W. Diebel	32,232
Pillow top, R. Astarita	32,239
Scarf, neck, W. O. Horn	32,240
Seal press body, hand, Sigwalt & Willard	32,214
Tongs handle slide, C. A. Sutton	32,223
Toy engine frame, R. Glinka	32,236
Trimming, H. A. Schaefer	32,242, 32,243
Vapor burner, I. N. Marquis	32,213
Washer, metallic fastening, E. D. Dougherty	32,218

TRADE MARKS.

Books, certain named, Concordia Publishing House	34,183
Boots and shoes, Rice & Hutchins	34,179, 34,180
Canned vegetables and fruits in cans, jars, or bottles, Sturtevant, Merrick & Company	34,198
Cement, certain named, Eclipse Cement and Blacking Company	34,206
Cigars, cigarettes, cheroots, and smoking tobacco, C. M. Clime & Brother	34,192
Cotton cloth, Belton Mills	34,176
Cotton goods, including mercerized cotton, N. Erlanger, Blumgart & Company	34,177
Extract as a beverage ingredient, H. Curiel	34,190
Fats, edible, Christr. Thomas & Brothers	34,193 to 34,195
Fly paper, sticky, F. A. Marsh	34,189
Floor dressing, Masury, Young & Company	34,205
Flour, J. Boyd, Jr. & Company	34,199
Groceries, certain named, Cudahy Packing Company	34,196
Grocers' specialties, certain named, Chas. W. Huff Company	34,197
Hats and caps, John B. Stetson Company	34,174, 34,175
Hinges, Bommer Brothers	34,207
Horse covers, Pittsburg Waterproof Company	34,181, 34,182
Hosiery, underwear, and ribbons, S. Scheyer	34,178
Liniment, McConnon & Company	34,203
Photographic dry plates, films, and developers, M. A. Seed Dry Plate Company	34,184
Preparation for the stomach and digestive organs, J. Morrow & Company	34,201
Puzzles, New York Puzzle Company	34,187, 34,188
Remedy for hay fever, E. M. Nichols	34,202
Sewing machines and attachments, New Home Sewing Machine Company	34,208
Soap, J. H. Keller's Soap Works	34,200
Stereoscopes, hand, H. C. White Company	34,185, 34,186
Varnish, shellac, Berry Brothers	34,204
Wines and other beverages, product for preserving and improving, A. C. Appert	34,191

LABELS.

"Amargo Sulfuroso del Dr. Kaufmann," for bitters, A. P. Ordway & Company	7,344
"Blue Moire Antique Natural Early June Peas," for canned goods, United States Printing Company	7,339
"Chocolate Cathartics," for a candy cathartic, T. H. Mitchell	7,346
"Flecha Beer," for bottled beer, Joseph Fallert Brewing Company	7,343
"Goodwin's Cream Paste," for cream paste, Goodwin, Allan & Company	7,348
"Isit Silk," for dry goods, W. Simpson Sons & Company	7,350
"Lowney's Chocolates" for confectionery in boxes, Walter M. Lowney Company	7,345
"Natural Clams," for canned goods, United States Printing Company	7,338
"Natural Sliced Beets," for canned goods, United States Printing Company	7,337
"Pink Checker Board Natural Stringless Beans," for canned goods, United States Printing Company	7,336
"Red Cross Pile Cure," for a medicine, W. D. Rea	7,347
"Rodentene," for an animal poison, H. Gellner	7,349
"Royal Arch Whisky," for whisky, T. J. Turner	7,342
"Sir Knight's Delight," for cigars, T. J. Turner	7,341
"Smell Sweet," for a perfumed tablet, Bay State Drug and Chemical Company	7,340
"Tri-Wear," for shoes, W. Hahn	7,335

PRINTS.

"Magnet Waist," for ladies' waists, M. Nathan..... 202

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Request Instructive Booklet No. D.

Size 4½ x 1½ x ¾ in.

GOLDMAN'S ARITHMACHINE

Weight about One Pound.

Patents allowed.

SMALLEST, LIGHTEST, CHEAPEST.

Practical Computing Machine, adds, subtracts, multiplies, divides, etc. Carries all columns automatically. Answers every practical requirement. No keys, bars, pins, disks, tapes, cranks! Makes Experts of Beginners. Saves Expert's Mental Strain. **MECHANICAL ARITHMETIC**, its history, methods and advantages thoroughly presented in Goldman's Arithmachines. 150 Pages of exceptionally interesting information, not contained in any other work, beautifully illustrated. Sent, postpaid, on receipt of $1, which will be allowed on the ARITHMACHINE.

The International Arithmachine Co.,
141-149 LA SALLE ST., (Roanoke Building) CHICAGO, ILL

THE "HOGGSON"
POCKET TIME STAMP

Prints Year, Month, Day, Hour and Minute. Correctly timing every act, operation or transaction. Watchman and Employés' register, general time and check system, an absolute necessity in every business. Air cushion base. Operated without pounding. Complete with die and ink ready for use. ☞ *Guaranteed for perfect work and correct time, or money refunded.*

27 Thames St., N. Y.

THE HOMEMADE WINDMILLS OF NEBRASKA.

A most valuable series of articles condensed from the official Bulletin by Erwin Hinckley Barbour, is published in Supplements Nos. **1254, 1255** and **1256.** The series is accompanied by thirty-three illustrations and gives a detailed description of a number of types of windmills which can be made by anyone who has any mechanical skill. These windmills are being made and used in large numbers in Nebraska and are giving great satisfaction. These Supplements for sale by all newsdealers, 10 cents each, or by MUNN & Co., 361 Broadway, New York City.

50 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &C.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, **New York**
Branch Office, 625 F St., Washington, D. C.

D. L. HOLDEN
1336 BEACH ST. PHILADELPHIA PA.
SOLE MANUFACTURER
REGEALED ICE MACHINES
SEE FIRST PAGE SCIENTIFIC AMERICAN SEPT. 2. 1899.

A. W. FABER

Manufactory Established 1761.

LEAD PENCILS, COLORED PENCILS, SLATE PENCILS, WRITING SLATES, STEEL PENS, GOLD PENS, INKS, PENCIL CASES IN SILVER AND IN GOLD, STATIONERS' RUBBER GOODS, RULERS, COLORS AND ARTISTS' MATERIALS.

78 Reade Street. - - - New York, N. Y.

Manufactory Established 1761.

NO BETTER INCUBATORS and none that hatch a greater percentage of good eggs with less attention or at less expense. Our catalogue **PRINTED IN 5 LANGUAGES** tells all about it—illustrations, descriptions and prices. Sent for 6c.

DES MOINES INCUBATOR CO.,
Box 75. Des Moines, Ia.

METHODS AND INSTRUMENTS USED

in Astronomy.—An illustrated description of the telescopes in the Lick and Paris Observatories 6 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT **1120.** Price 10 cents For sale by Munn & Co. and all newsdealers. Send for new 1897 catalogue.

NOW FOR 1900

Always abreast of the times. Get the latest and best, **The 20th Century Poultry Book.** Not an ordinary catalogue. It contains about everything that one could wish to know about poultry. Tells also about the world famous **Reliable Incubators** and **Brooders** used throughout the U. S. and 51 foreign countries. Book mailed for 10c.

RELIABLE INC. & BROODER CO., Box B 105 Quincy, Ill.

IT COST US **$4,000** Costs You **15c**

We have spent $4,000 on our new book, **"How to Make Money with Poultry and Incubators."** It tells it all. Leading poultry men have written special articles for it. 192 pages, 8x11 in. Illustrated. It's as good as

Cyphers Incubator

—and it's the best. Out hatch any other machine. 16 page circular free. Send 15 cts. in stamps for $4.000 book No. 134.

Address nearest office. Boston, Mass.
CYPHERS INCUBATOR CO. Wayland, N. Y. Chicago, Ill.

The WOODEN HEN

A high class self-regulating incubator on a small scale. Fifty egg capacity. Heat, moisture and ventilation automatically and perfectly controlled. Price only $7.

Send for the **Wooden Hen Book;** mailed free, together with a book about the **EXCELSIOR INCUBATOR,** to those who name this paper.

GEO. H. STAHL, Quincy, Illinois.

For Sale

Steam Engine built by the Watts Campbell Company, of Newark, N. J. Engine consists of two horizontal condensing Corliss engines coupled to one shaft, with vertical air pump driven from crank pin. The cylinders are 32 in. bore, 60 in. stroke. Belt wheel is 26 ft. dia. by 114 in. face. Gross weight is about 225,000 lbs. Can be seen in operation now; probably ready for delivery in May, 1900. Apply to The Clark Thread Co., P. O. Box 154, Newark, N. J.

TURBINES

☞ Send for Circular "M."
JAS. LEFFEL & CO.
Springfield, Ohio, U. S. A.

MODELS & EXPERIMENTAL WORK.

Inventions developed. Special Machinery.
E. V. Baillard, 106 Liberty St., New York.

FOR SALE

at bargain price, a 50 to 60 h. p. Corliss Engine in fine condition. A. J. VANDEVENTER, 27 Thames St., New York City.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery.

THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

STENCIL TYPEWRITER STYLE
TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST N.Y.

FOR STEREOPTICONS AND SLIDES

Moving Picture Machines and Films, write Williams, Brown & Earle, 920 Chestnut St., Philadelphia, Pa.

INVENTIONS PERFECTED.

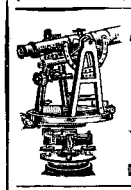
Accurate Model and Tool Work. Write for Circular.
PARSELL & WEED, 129-131 West 31st St., New York.

D'AMOUR & LITTLEDALE MACHINE CO.

130 WORTH ST. NEW YORK.
Make Models of Any Machine to Order.

CALCIUM CARBIDE EXPORT COMP'Y,

35 NASSAU STREET, NEW YORK.
(A B C Code.) Cable Address: BRYAXE, NEW YORK.



Astronomical AND Engineering Instruments
MANUFACTURED BY
W. & D. MOGEY,
Bayonne City, N. J.
☞ *Send for Catalogue.*

AIR BRUSH FOR ART WORK.

We are making and selling the best Art Tool in use. Applies color by jet of air, enabling the artist to do better work and save time for the architect and the draftsman. Circulars free. Address,

AIR BRUSH MFG. CO.,
80 Nassau Street,
Rockford, Ill., U. S. A.

$5,000 POULTRY CATALOGUE FREE!

It is without a rival. Gives lowest prices of fowls and eggs. Over 50 breeds Turkeys, Geese, Ducks and Chickens. Hundreds of plates from life. 15 best poultry house plans. Treatise on diseases, how to feed, breed, etc. Send 10c. for postage.
J. R. Brabazon, Jr. & Co., Box 69, Delavan, Wis.

310 First Premiums

Awarded to the PRAIRIE STATE INCUBATOR. Guaranteed to operate in any climate. Send for catalogue.
PRAIRIE STATE INCUBATOR CO. Homer City, Pa.

PEASE PAYS EXPENSES and $75

per month. Steady position; self-seller; no experience needed. Send 2c for contract.
PEASE MFG. Co., Cincinnati, O., Dept. 10.

YOU CAN MAKE $100. A WEEK!

OWN YOUR OWN SHOW. COMPLETE OUTFIT—$100.
LIFE MOTION FILMS & MACHINES.
GREAT PASSION PLAY & 500 OTHER SUBJECTS.
ILLUSTR. CATALOGUES FREE.
S. LUBIN, LARGEST MFR. PHILADELPHIA P.A.

BABBITT METALS.—SIX IMPORTANT

formulas. SCIENTIFIC AMERICAN SUPPLEMENT **1123.** Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for 1897 catalogue.

$3 a Day Sure

Send us your address and we will show you how to make $3 a day absolutely sure; we furnish the work and teach you free; you work in the locality where you live. Send us your address and we will explain the business fully; remember we guarantee a clear profit of $3 for every day's work, absolutely sure, write at once.
ROYAL MANUFACTURING CO., Box 1 1 DETROIT, MICH.

1900 BICYCLE FREE

For distributing 1000 catalogues for us. One Agent wanted in each town. Give references and send for catalogues. Enclose stamp.
MEAD CYCLE CO. Dept. 62 X, Chicago

Brass Band

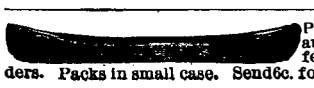
Instruments, Drums, Uniforms & Supplies. Write for catalog, 445 illustrations. FREE; it gives Music and Instructions for New Bands.
LYON & HEALY,
58 Adams St., CHICAGO.

Automobiles

The SCIENTIFIC AMERICAN for May 13, 1899, is devoted mainly to illustrations and detailed descriptions of various types of horseless vehicles, This issue also contains an article on the mechanics of the bicycle and detailed drawings of an automobile tricycle. Price 10 cents.

The following copies of the SCIENTIFIC AMERICAN SUPPLEMENT give many details, of Automobiles of different types, with many illustrations of the vehicles, motors, boilers, etc. The series make a very valuable treatise on the subject. The numbers are: 732, 979, 993, 1053, 1054, 1055, 1056, 1057, 1058, 1059, 1075, 1078, 1080, 1082, 1083, 1099, 1100, 1113, 1122, 1178, 1195, 1199, 1206, 1210. SUPPLEMENT No. 1229 contains a highly interesting article giving full data as to operating costs of horse and electric delivery wagons in New York City. Price 10 cents each, by mail. For sale by all newsdealers or address

MUNN & CO. Publishers,
361 BROADWAY, NEW YORK.



Puncture-proof Folding Boats. Adopted by U. S. War and Navy depts. in March and Sept. 1899 Only Medal and Award at World's Fair. Beautiful models, perfectly safe for family as well as sportsmen's use. Sails, centreboards, rudders. Packs in small case. Send 6c. for catalog. 50 engravings. King Folding Canvas Boat Co., Kalamazoo, Mich.

THOROUGH INSPECTIONS

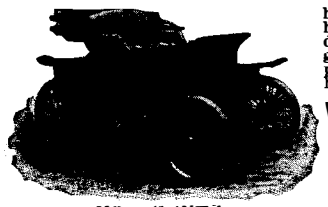
HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY

STEAM BOILER EXPLOSIONS

J. M. ALLEN, PRESIDENT · W. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY · F. B. ALLEN, 2D VICE PRESIDENT
L. R. BRAINERD, ASST TREAS. · L. F. MIDDLEBROOK, ASST SECY

Frost Bound Roads



hinder the horses and render driving dangerous. You are perfectly safe, however, in a

Winton Motor Carriage

which needs no horse. You enjoy the sensation of perfect independence which it gives. Clean, durable, noiseless, economical. Hydro rbon system. *Send for catalogue to*

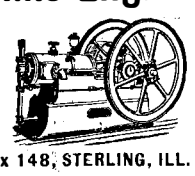
NO AGENTS.

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.

Eastern Department, 120 Broadway, New York City.

CHARTER Gasoline Engine

USED ANY PLACE BY ANYONE FOR ANY PURPOSE



Stationaries, Portables, Engines and Pumps.

☞ State your Power Needs.

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

Storage Batteries

Morrison System.

NO Cast Plates. Perforations. Applied Paste. Infringement.

Long Life. High Efficiency. Great Capacity. Superiority.

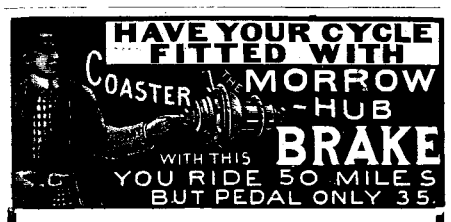
Electric Chemical Formations for all Purposes.
Central Station, Power and Isolated Plants.
Automobile Cells a Specialty.
Send us size of your Containing Cells and Specifications.

☞ *Send for Circular S. A.*

HELIOS-UPTON CO.,

Address all communications to

224 Fullerton Avenue, Chicago, Ill.



OVER 25,000 IN USE.

EASILY PUT ON. HAS PROVED PERFECT AND RELIABLE. FULLY GUARANTEED.

Coasting becomes so safe and easy you do it every chance you get. Your feet on the pedals gives perfect control of the wheel. Ladies' skirts keep down when coasting. You can adjust it to any make of cycle.

Our **Acetylene Bicycle Lamp** is superior in construction to any made.

Illustrated pamphlet giving detailed information regarding Brake and Lamp, sent on application.

ECLIPSE BICYCLE CO.

Box X, ELMIRA, N. Y.

CHRISTIANA MACHINE COMPANY,

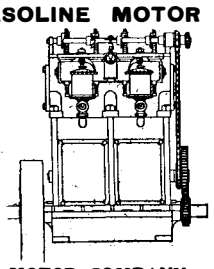
Established 1862. CHRISTIANA, PA., U.S.A.

Engineers, Founders, and Machinists.

Manufacturers of **Turbine Water Wheels,** adapted to all duties, **Power Transmitting Machinery,** Gearing, Rope Wheels, Friction Clutches, Shafting, Pulleys, Hangers, etc. ☞ *Catalogues on application.*

THE BUFFALO GASOLINE MOTOR

THIS cut shows our four cylinder, 4½ horse power, non-vibrating, shifting spark, varying speed from 100 to 1,500 revolutions, Gasolene Vehicle Motor, which we have demonstrated to be the most practical power in the market, occupying a space of 18 x 20 inches, manufactured upright or horizontal; weight 175 pounds. We build from one to eight horse power. For vehicles, boats and light stationary work, we can prove superiority.



☞ *Send for Circular.*

BUFFALO GASOLENE MOTOR COMPANY,
Dewitt and Bradley Streets, Buffalo, N. Y.

THE "CHALLENGE" SAFETY RAZOR.

THE BEST, SAFEST, QUICKEST, CLEANEST, SMALLEST AND MOST PRACTICAL RAZOR IN THE WORLD.

Price $1.00 complete in neat tin case.

☞ Send for Circular. Address

RAZOR READY FOR SHAVING.

CHALLENGE CUTLERY CORP'N, P. O. BOX 96, NEW YORK.

The Force behind the force

is the educated mind which plans and directs the work of others. You can rise to a higher position without interrupting your work or leaving home. You can get

A Technical Education BY MAIL.

We have prepared successful **Mechanical or Architectural Draughtsmen, Electrical or Steam Engineers, Architects, Surveyors, Chemists, Correspondents, Stenographers** and **Bookkeepers.** Write for circular. Mention the profession you wish to enter.

The International Correspondence Schools, Box 942 Scranton, Pa.

OLMSTED'S IMPROVED MITRE BOX

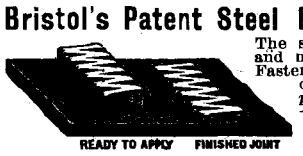
Six Styles and Sizes. Adjustable Iron Saw Guides prevent saw cutting frame, and insures *Perfect Work. Any Saw Can Be Used.*

No. 6 Universal Box, made of iron and steel, will saw any angle.

Sold by hardware trade everywhere. ☞ *Send for Circular and Price List.*

L. H. OLMSTED, P.O. Box 45, Hasbrouck Heights, N. J.

Bristol's Patent Steel Belt Lacing.



The simplest, cheapest and most perfect Belt Fastening for all kinds of belting. *Samples sent free.*

The Bristol Co.
Waterbury Conn.

P. T. AUSTEN, Ph.D., *President.* F. J. MAYWALD, *Vice-Pres.* L. S. MOTT, *Sec. and Treas.*

The Austen Chemical Research Co.

Experimental Investigation of Technical Problems. Research Work for Manufacturers. Improvement and Invention of Processes and Products. Utilization of Wastes and Unapplied Substances. Reduction of Manufacturing Costs. Testing, Perfecting, Introducing and Disposing of Processes and Products. Manufacturing Formulas. ☞ *Explanatory Circular on Application.*

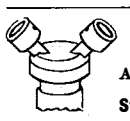
52 BEAVER STREET, NEW YORK.

The Blue Book

illustrates the most fashionable designs of ladies' diminutive watches, in exquisite iridescent and dull enamels, in color or harmony with the prevailing dress colors; also all the gold, silver and other metal cases. *The Blue Book* will be sent free on application.

New England Watch Co., 37-39 Maiden Lane, N.Y.

BICYCLE TIRE REPAIRING.—THE Mending of Single Tube Tires.—A practical article illustrating the method of inserting patches and plugs with pliers and pluggers, together with rubber band plugging and the use of puncture bands. 9 illustrations. Contained in SUPPLEMENT 1102. Price 10 cents. For sale by Munn & Co. and all newsdealers.



Acetylene Burners.

Samples, ¼ to 1 foot, 25c. each.
A new burner for **STEREOPTICONS.**
Highest C. P. possible.
State Line Talc Co., Chattanooga, Tenn.

SPEED SAFETY COMFORT

CAPE NOME, CAPE YORKE, ST. MICHAELS, DAWSON

AND ALL POINTS ON THE YUKON RIVER

DIRECT.

Operating ITS OWN Fleet of First-Class Ocean Steamships

ST. PAUL, PORTLAND, BERTHA, RAINIER, DORA and others.

Full Line of River Steamers on the Yukon under contract to deliver United States Mails throughout the Territory.

First Departure, APRIL 30th, and Fortnightly thereafter.

Write ALASKA COMMERCIAL COMPANY,

310 SANSOME STREET, SAN FRANCISCO, CAL., for all particulars.

BILLS OF EXCHANGE ISSUED TO ALL ALASKA POINTS.

WORK SHOPS

of Wood and Metal Workers, without steam power, equipped with

BARNES' FOOT POWER MACHINERY

allow lower bids on jobs, and give greater profit on the work. Machines sent on trial if desired. *Catalog Free.*

W. F. & JOHN BARNES CO.
1999 RUBY ST., ROCKFORD ILL.

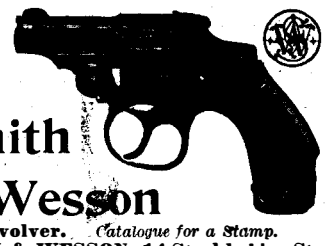
REVERSING STEAM TURBINE.—PARSON'S recently perfected turbine for boats. Illustrations showing details. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1158. Price 10 cents, by mail, from this office, and from all newsdealers.

A SMALL CAPITAL brings good returns if invested in a **MAGIC LANTERN** or **Stereopticon** for exhibition purposes. Write for 256 page illustrated catalogue free.

McALLISTER, Mfg. Optician, 49 Nassau St., N.Y.

Burglar Alarm.

The BEST is a **Smith & Wesson**



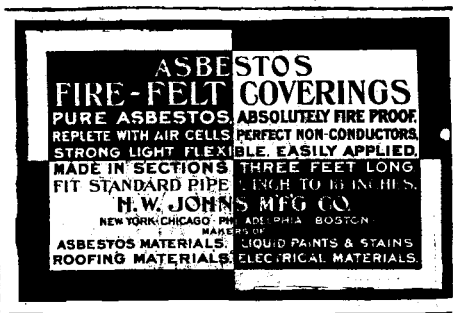
Revolver. *Catalogue for a Stamp.*

SMITH & WESSON, 14 Stockbridge St. Springfield, Mass.

159 New Montgomery St., San Francisco, Cal.

HIGH GRADE FOOT POWER LATHES

W. P. DAVIS, ROCHESTER, N. Y.


ASBESTOS
FIRE-FELT COVERINGS
PURE ASBESTOS. ABSOLUTELY FIRE PROOF.
REPLETE WITH AIR CELLS. PERFECT NON-CONDUCTORS.
STRONG LIGHT FLEXIBLE. EASILY APPLIED.
MADE IN SECTIONS THREE FEET LONG
FIT STANDARD PIPE EIGHT TO 18 INCHES.
H. W. JOHNS MFG CO.
NEW YORK CHICAGO PHILADELPHIA BOSTON
MAKERS OF
ASBESTOS MATERIALS. LIQUID PAINTS & STAINS
ROOFING MATERIALS. ELECTRICAL MATERIALS.

"TRADE MARK PEGAMOID" ALUMINUM PAINT.

Latest application of Aluminum. Looks like Frosted Silver. Washable, Untarnishable, Water, Oil and Weatherproof. Durable, Easily Applied. Bicycles, Yachts, Radiators, Pipes, Metal Work, Machinery, Dynamos, Motors. Apparatus, Arc Lamps, Sockets, Brackets, Cars, Stations, General Decoration, etc. Sample bottle, by mail, for 25 cents.

THE AMERICAN PEGAMOID CO., 339 B'way, New York.

INCOMPARABLE FOR THEIR GREAT CREAMY LUXURIOUS LATHER
WILLIAMS'
SHAVING SOAPS
SOLD EVERYWHERE
Williams' Shaving Stick, 25 cts.
Genuine Yankee Shaving Soap, 10 cts.
Luxury Shaving Tablet, 25 cts.
Swiss Violet Shaving Cream, 50 cts.
Jersey Cream (Toilet) Soap, 15 cts.
Williams' Shaving Soap (Barbers'), 6 Round Cakes, 1 lb., 40c. Exquisite also for toilet. Trial cake for 2c. stamp.
THE J. B. WILLIAMS CO.
GLASTONBURY CONN.

HARVARD UNIVERSITY.

Lawrence Scientific School.

Twelve Departments of study leading to the degree of Bachelor of Science. Civil Engineering. Electrical Engineering. Mechanical Engineering, Mining and Metallurgy, Architecture, Landscape Architecture, Chemistry, Geology, Biology, Anatomy and Physiology, For Teachers of Science, and General Science.

For Descriptive Pamphlet apply to
J. L. LOVE, Sec'y, Cambridge, Mass.
N. S. SHALER, Dean.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS LTD 91 JOHN ST. NEW YORK

PRINTING INKS

The SCIENTIFIC AMERICAN is printed with CHAS ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

TEN-YEAR TEST.

The following letter from one of the largest cement manufacturers in the world proves positively the marked superiority of **THE GRIFFIN MILL** for pulverizing either rock or cement clinker.

AMERICAN CEMENT COMPANY,

OWNERS OF

The Egypt Portland Cement Works. *The Pennsylvania Portland Cement Works.* *The Columbian Portland Cement Works.* *The Giant Portland Cement Works.* *The Jordan, N. Y., Portland Cement Works.*

Messrs. BRADLEY PULVERIZER CO. EGYPT, PENN., August 25, 1899.

Gentlemen: Replying to your inquiry as to what we think of **THE GRIFFIN MILL,** we will say that the first Griffin Mill used in grinding Portland cement was erected in our Egypt works ten years ago, where it is still in operation. Since then, as from time to time we have built new works, we have equipped them all with Griffin Mills. We have now in operation at our several works, thirty-seven mills.

We know all about the grinding machinery used in the various cement works in this country, but think the Griffin Mill superior to any other for grinding Portland cement and the raw material from which it is made. What we think of the Griffin Mill is shown by the fact that within the last week we have given you an additional order for more mills.

Yours very truly, AMERICAN CEMENT CO.,
JOHN W. ECKERT, President.

The demonstrated success of the GRIFFIN MILL for pulverizing all refractory substances allows us to sell them on their established record. Write us for names of manufacturers who are daily using them with perfect satisfaction.

THE BRADLEY PULVERIZER CO., = = Boston, Mass.